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NAS JACKSONVILLE
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FIELD SAMPLING AND ANALYSIS PLAN FOR PHASE I REMEDIAL INVESTIGATION AND
RESPONSES TO COMMENTS POTENTIAL SOURCE OF CONTAMINATION 3 (PSC 3) NAS
JACKSONVILLE FL
12/12/2011
TETRA TECH



TETRA TECH

Document Tracking Number 12JAX0035

December 12, 2011

Project Number 112G02686

Ms. Adrienne Wilson
Remedial Project Manager
Code OPDE3/AW
Department of the Navy
Naval Facilities Southeast
ATTN: Ajax Street, Building 135N
P.O. Box 30A
NAS Jacksonville, FL 32212-0030

Reference: CLEAN V Contract Number N62470-08-D-1001
Contract Task Order Number JM19

Subject: Final Sampling and Analysis Plan (SAP) (Field Sampling Plan and
Quality Assurance Project Plan) for Phase I Remedial Investigation for
Potential Sources of Contamination 38 and Responses to Comments
Naval Air Station Jacksonville
Jacksonville, Florida

Dear Ms. Wilson:

Tetra Tech NUS, Inc. (Tetra Tech) is pleased to present the Final Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) for Phase I Remedial Investigation for Potential Source of Contamination (PSC) 38, Naval Air Station Jacksonville, Florida with the response to comments to the Draft-Final Sampling and Analysis Plan. A copy of this document has also been forwarded to the NAS Jacksonville Partnering Team members listed below.

If you have any questions regarding the enclosed material, or if I can be of assistance in any way, please contact me at (904) 730-4669, extension 213, or by e-mail at Mark.Peterson@tetrattech.com.

Sincerely,

Mark A. Peterson
Task Order Manager

Enclosure

c: Tim Curtin, NAS Jacksonville
Pete Dao, USEPA
David Grabka, FDEP
Garth Glenn, Tetra Tech (cover letter only)
John Trepanowski, Tetra Tech (cover letter only)
CTO JM19 Project File

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UFP-SAP Review

Reviewer: NAS Jacksonville Partnering Team

Document: PSC 38 - UFP SAP for Phase I Remedial Investigation

Date: 12-Dec-11

Comment Number	Worksheet and/or Section	Reviewer	Statement or Issue	Comment	Response to Comment
1	10	Adrienne Wilson, NAVFAC SE RPM		Not sure we should be using the PHA since its data can not be verified and seems contrary to logic. They found only surface soil contamination even though that is not likely due to rain forcing any contaminants to the subsurface. Good caveat saying they PHA info could not be verified.	We will not be using the information in the PHA to shape the direction of the investigation. References to the PHA are included for the sake of completeness.
2	10	Adrienne Wilson, NAVFAC SE RPM		g 33 delete the word "is" paragraph 6 line 1	The text was changed.
3	10	Adrienne Wilson, NAVFAC SE RPM		pg 33 paragraph 7 regarding focused risk evals change "an" to "a".	The text was changed.
4	10	Adrienne Wilson, NAVFAC SE RPM		pg 35 para 2 sec 10.4.2-delete sentence beginning with : "will be scrubbed..."	Deleted remainder of sentence starting with "Will be scrubbed..."
5	10	Adrienne Wilson, NAVFAC SE RPM		Pg 38 para 3-delete word "extreme" throughout paragraph	Deleted all instances of "extreme" used.

UFP-SAP Review

Comment Number	Worksheet and/or Section	Reviewer	Statement or Issue	Comment	Response to Comment
6	11	Adrienne Wilson, NAVFAC SE RPM		Pg 44 change wording to "the most conservative or the lesser value of FDEP or USEPA criteria shall be used".	Corrected sentence to read "The soil and groundwater PALs are the NAS Jacksonville basewide background values (see Appendix B), if the NAS Jacksonville background values are greater than the state (FDEP) or federal (USEPA) criteria, otherwise the most conservative or lesser value of the FDEP or USEPA criteria shall be used"
7	11	Adrienne Wilson, NAVFAC SE RPM		pg. 44-not sure why the reference to metals and the background PALs was deleted in the document. Doesn't this mean only backgrounds for metals were determined at NAS JAX?	Tetra Tech could not find where the reference to metals and the background PALs was deleted. Appendix B is entitled "NAS Jacksonville Background Data PALs for Metals". Information on non-metal compounds is available. However only the information related to the background concentrations of metals will be used to evaluate the findings.
8	9	Tim Curtin, NAVFAC SE IR Mgr		Page 27, line 20: Change "Material Data Safety Sheet" to "Material Safety Data Sheet".	The text was changed.

UFP-SAP Review

Comment Number	Worksheet and/or Section	Reviewer	Statement or Issue	Comment	Response to Comment
9	10	Tim Curtin, NAVFAC SE IR Mgr		Page 29, line 98: One 55 gal drum of solid waste per day seems excessively high. Also It would be hazardous waste not solid waste.	The information on the volume of waste material generated and the classification thereof was abstracted from HLA, 1999 which in turn reported summarized that was reported in HART, 1983. It was not possible to confirm the accuracy of the information reported in HLA, 1999. The citation in the text and the references were corrected (i.e., (Fred C. Hart Associates, Inc. [Hart], 1983, as referenced in HLA, 1999).
10	10	Tim Curtin, NAVFAC SE IR Mgr		Page 31, line 180: Delete "is" after "evaluation	Corrected text
11	10	Tim Curtin, NAVFAC SE IR Mgr		Page 33, line 228: If the Hawthorne Aquifer ranges from 35-400 feet bgs, are we in the Hawthorne at OU3, PSC 48 (60')?	Per Mark Peterson, we are not in the Hawthorne at OU 3 at (60')
12	10	Tim Curtin, NAVFAC SE IR Mgr		Page 33, line 245: Change "contamination was" to "contamination has been".	The text was changed.
13	10	Tim Curtin, NAVFAC SE IR Mgr		Page 33, line 253: Add "the" after "swept into".	Tetra Tech could not locate the text "swept into" in the document. Text likely was changed addressing another reviewer's comment.
14	10	Tim Curtin, NAVFAC SE IR Mgr		Page 34, line 269: I checked with our resident weapons guy. Otto fuel is only used in torpedoes. Delete "and other weapon systems".	The text was changed.

UFP-SAP Review

Comment Number	Worksheet and/or Section	Reviewer	Statement or Issue	Comment	Response to Comment
15	10	Tim Curtin, NAVFAC SE IR Mgr		Page 34, lines 275-276: Was that a good decision not to analyze for Otto fuel and its breakdown products. I would think it would be relatively easy to do during the Phase 1 of the RI. If we don't find anything we can discontinue looking for it. This reminds me of the lack of soil data in OU3 that we are now struggling with.	Please see the response to Comments 21 and 23
16	10	Tim Curtin, NAVFAC SE IR Mgr		Page 36, line 351: Change "analyte" to "analytes".	The text was changed.
17	10	Tim Curtin, NAVFAC SE IR Mgr		Page 39, Figure 10-2: Add building numbers.	The figure was updated.
18	11	Tim Curtin, NAVFAC SE IR Mgr		Page 42, lines 458-459: Move "are" to after "PALs".	The text was changed.
19	14	Tim Curtin, NAVFAC SE IR Mgr		Page 51, lines 69-71: How do you know when you have advanced through a significant clay unit until after you do it? Do you stop after 2 feet and assume it's "significant"?	Prior to mobilizing, the current information on the shallow lithology is communicated to the Tetra Tech professional who will monitor the DPT drilling. The Tetra Tech professional's knowledge of the area and the Tetra Tech professional's knowledge of how the DPT rig responds to subsurface conditions enables the Tetra Tech professional to stop the DPT rig from advancing the drive rod through the confining unit.

UFP-SAP Review

Comment Number	Worksheet and/or Section	Reviewer	Statement or Issue	Comment	Response to Comment
20	14	Tim Curtin, NAVFAC SE IR Mgr		Page 49, line 14: There may be a HERO, Hazards to Electromagnetic Radiation to Ordnance, issue with the GPS transmitter. You will have to provide more information to the station Explosives Safety Officer. He will need frequencies, transmitter power and location information.	The GPS will be only used to determine locations. The GPS will not be in transmit mode. Information on make/model of the GPS unit will be provided to the Explosive Safety Officer before the unit is placed in use. The language in the text was revised accordingly.
21		Dave Grabka, FDEP		The constituents in Otto Fuel II, which is the fuel/propellant used in torpedoes, are dismissed as possible contaminants on page 34. It appears as though the point made on page 34, second paragraph, is that based on site history, the chemicals in Otto Fuel II would not be expected to be found in the environment. In actuality, it appears that the physical properties of the chemicals and their ability to be broken down by micro-organisms in soil and water are the main arguments made. I would like a more thorough evaluation of the work done at the torpedo rework facility, opportunities for spills or mishandling of Otto Fuel II or wastes contaminated with Otto Fuel II (i.e. rags), and where the Otto Fuel II was stored and where drums containing waste contaminated with Otto Fuel II were stored. Otherwise, I feel that dismissing of the chemicals in the Otto Fuel II from laboratory analysis may be construed as deliberately not analyzing for specific chemicals known to have been used at the site because the analytical method is not standard, a laboratory outside of our usual list of laboratories may be needed, or because it going to cost a lot more money to run samples for those non-standard chemicals	PGDN shall be added to COCs for soil and groundwater at six locations around suspected Otto Fuel areas. This shall be done through a field task modification, due to the impact of this change to this work plan and most of the worksheets. A separate laboratory is being procured to analyze for PGDN per the Tetra Tech Chemist, Kelly Carper.
22	15	Dave Grabka, FDEP		In SAP Worksheet #15, page 70, the PALs for O-xylene and M+P-xylenes is listed as 1,200 ug/L. The Department's GCTL for total xylenes is 20 ug/L.	The GCTL for O-xylene and M+P-xylenes has been changed to 20 ug/L (total xylenes) which is the lower of the applicable state or federal screening criteria.

UFP-SAP Review

Comment Number	Worksheet and/or Section	Reviewer	Statement or Issue	Comment	Response to Comment
23		Dave Grabka, FDEP		I'm a little iffy about the Proposed Groundwater and Soil Sampling Locations on page 84, because the locations mostly seem to be biased toward a particular direction, but I realize that this is so because of what was detected in the Sampling Event Report and that I may have an opportunity to ask for samples in other parts of the site in a later phase.	Tetra Tech agrees with comment

Comprehensive **L**ong-term **E**nvironmental **A**ction **N**avy

CONTRACT NUMBER N62470-08-D-1001



Rev. 2
December 2011

Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Phase I Remedial Investigation for Potential Source of Contamination 38 Torpedo Rework Facility

**Naval Air Station Jacksonville
Jacksonville, Florida**

December 2011



NAS Jacksonville
Jacksonville, Florida 32212-0030

SAP Worksheet #1 -- Title and Approval Page
UFP-QAPP Manual Section 2.1

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)

December 2011

Phase I Remedial Investigation
for
Potential Source of Contamination (PSC) 38
Torpedo Rework Facility

Naval Air Station Jacksonville
Jacksonville, Florida

Prepared for:
Naval Facilities Engineering Command Southeast
Naval Air Station Jacksonville, Building 903
Jacksonville, Florida 32212-0030

Prepared by:
Tetra Tech NUS, Inc.
234 Mall Boulevard
King of Prussia, Pennsylvania 19406-2954

Prepared under:
Comprehensive Long-term Environmental Action Navy
Contract Number N62470-08-D-1001
Contract Task Order JM19

Project-Specific Sampling and Analysis Plan
Site Name/Project Name: PSC 38
Site Location: NAS Jacksonville, FL

Phase I Remedial Investigation
Revision Number: 1
Revision Date: August 2011

SAP Worksheet #1 - Approval Page

(UEP-QAPP Manual Section 2.1)

Document Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan),
Phase I Remedial Investigation for Potential Source of Contamination (PSC) 38, Naval
Air Station Jacksonville, Jacksonville, Florida

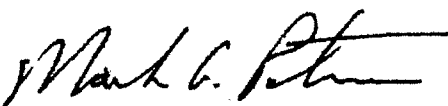
Lead Organization: Naval Facilities Engineering Command Southeast (NAVFAC SE)

Preparer's Name and Organizational Affiliation: Mark Traxler, Tetra Tech NUS, Inc.

Preparer's Address and Telephone Number: 234 Mall Boulevard, Suite 260
King of Prussia, PA 19406-2954
(610) 382-1171


Preparation Date (Day/Month/Year): June 9, 2011

Investigative Organization's Task Order Manager:



Signature/Date August 8, 2011
Mark A. Peterson, Tetra Tech NUS, Inc.

Investigative Organization's Project QA Manager:

 8-8-11

Signature/Date
Tom Johnston, Ph.D., Tetra Tech NUS, Inc.

Lead Organization's Remedial Project Manager:


Signature/Date
Adrienne Wilson, NAVFAC SE

Lead Organization's QA Officer:

NIELSEN.JANICE.
L.1069943540
Signature/Date
NAVFAC Atlantic Quality Assurance Officer Chemist

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DN: c=US, o=U.S. Government, ou=DoD, ou=PKI,
ou=USM, cn=NIELSEN.JANICE.L.1069943540
Date: 2011.08.09 17:18:58 -04'00'

Approval Signatures:

 11/17/11
Signature/Date
Peter Dao, USEPA Region 4

Signature/Date
David Grabka, FDEP

SAP Worksheet #1 - Approval Page
(UFP-QAPP Manual Section 2.1)

Document Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan),
Phase I Remedial Investigation for Potential Source of Contamination (PSC) 38, Naval
Air Station Jacksonville, Jacksonville, Florida

Lead Organization: Naval Facilities Engineering Command Southeast (NAVFAC SE)

Preparer's Name and Organizational Affiliation: Mark Traxler, Tetra Tech NUS, Inc.

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(610) 382-1171

Preparation Date (Day/Month/Year): June 9, 2011

Investigative Organization's Task Order Manager:



Signature/Date December 12, 2011
Mark A. Peterson, Tetra Tech NUS, Inc.

Investigative Organization's Project QA Manager:

Signature/Date
Tom Johnston, Ph.D., Tetra Tech NUS, Inc.

Lead Organization's Remedial Project Manager:

Signature/Date
Adrienne Wilson, NAVFAC SE

Lead Organization's QA Officer:

Signature/Date
NAVFAC Atlantic Quality Assurance Officer Chemist

Approval Signatures:

Signature/Date
Peter Dao, USEPA Region 4

Signature/Date
David Grabka, FDEP

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. has prepared this Sampling and Analysis Plan (SAP) that encompasses Field Sampling Plan and Quality Assurance Project Plan requirements for a Phase I Remedial Investigation (RI) at Potential Source of Contamination (PSC) 38 at Naval Air Station (NAS) Jacksonville located in Jacksonville, Florida under the Comprehensive Long-term Environmental Action Navy Contract Number N62470-08-D-1001, Contract Task Order JM19. The location of PSC 38 within the installation is presented on Figure ES-1.

This plan was generated for and complies with applicable United States Department of the Navy, United States Environmental Protection Agency (USEPA) Region 4, and Florida Department of Environmental Protection (FDEP) requirements, regulations, guidance, and technical standards. This includes the Department of Defense, Department of Energy, and USEPA Interagency Data Quality Task Force (IDQTF) environmental requirements regarding federal facilities. To comply with IDQTF requirements, this Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) is presented in the format of standard worksheets specified as in the Uniform Federal Policy Quality Assurance Project Plan guidance documents (USEPA, 2005).

This SAP outlines the organization, project management, objectives, planned activities, measurement, data acquisition, assessment, oversight, and data review procedures associated with the planned Phase I RI at PSC 38, the Torpedo Rework Facility. Protocols for sample collection, handling, and storage, chain-of-custody, laboratory and field analyses, data validation, and reporting are also addressed in this SAP.

Historical site operations at PSC 38, including fuel storage and the overhaul, maintenance, repair and reworking of torpedoes, may have resulted in chemical releases to the environment. Additionally, unmonitored underground storage tanks, lead acid battery disposal areas, and gravel sumps may have contributed contaminants to the site. The previously collected data for PSC 38 is summarized in a 1999 Sampling Event Report (Harding Lawson Associates [HLA], 1999), which included a limited soil, sediment, surface water, and groundwater investigation. In Section 5.0, Risk Evaluation, HLA identified certain contaminants that exceeded regulatory criteria including one surface soil sample immediately adjacent to one of the gravel sumps that contained lead in excess of the then-current FDEP Soil Cleanup Target Levels and one groundwater sample taken from the eastern side of PSC 38 that contained trichloroethene and its breakdown products 1,2-dichloroethene and vinyl chloride in excess of the FDEP Groundwater Cleanup Target Levels and the Federal Maximum Contaminant Levels .

The purpose of the RI for PSC 38 is to obtain sufficient data to determine the nature and extent of contamination and if contaminants exist in exceedance of the current risk-based screening levels, to evaluate the potential risk to human receptors caused by the release of contaminants at or from the Site.

During Phase I of the RI, one sampling event is planned that will generate the information needed by the NAS Jacksonville Partnering Team (Partnering Team) to make appropriate decisions regarding potential future investigative and remedial actions at PSC 38. Both groundwater and soil samples will be collected and analyzed for a wide range of target analytes. The reported concentrations of target analytes will be compared against the applicable Project Action Limits, which are conservative, risk-based, and regulatory screening criteria. Decisions related to any further action at PSC 38 will be made by the Partnering Team based on the Phase I results.

During Phase II of the RI, the delineation of the nature and extent of contamination will be completed as necessary, and sufficient numbers of samples will be collected to support a human health risk assessment and, if appropriate an Engineering Evaluation and Cost Analysis (EECA) for the removal of impacted media.

P:\GIS\JACKSONVILLE_NAS\MXD\PSC38_FACILITY.MXD 12/23/10 KM




DRAWN BY K. MOORE		DATE 12/23/10			PSC 38 SITE LOCATION MAP NAS JACKSONVILLE JACKSONVILLE, FLORIDA				CONTRACT NUMBER CTO JM19			
CHECKED BY J. JOHNSON		DATE 12/23/10							APPROVED BY _____		DATE _____	
REVISED BY _____		DATE _____							APPROVED BY _____		DATE _____	
SCALE AS NOTED								FIGURE NO. ES-1		REV 0		

TABLE OF CONTENTS

<u>SAP Worksheets</u>	<u>Page</u>
#1 -- Title and Approval Page	1
#2 -- SAP Identifying Information	12
#3 -- Distribution List.....	13
#4 -- Project Personnel Sign-Off Sheet.....	16
#5 -- Project Organizational Chart.....	19
#6 -- Communication Pathways	20
#7 -- Responsibilities and Qualifications Table	23
#8 -- Special Personnel Training Requirements Table	25
#9 -- Internal Project Scoping Session Participants Sheet.....	26
#10 -- Conceptual Site Model.....	29
#11 -- Data Quality Objectives/Systematic Planning Process Statements	42
#12 -- Measurement Performance Criteria Table - Field Quality Control Samples.....	48
#13 -- Secondary Data Criteria and Limitations Table	49
#14 -- Summary of Project Tasks.....	50
#15 -- Reference Limits and Evaluation Table	58
#16 -- Project Schedule / Timeline Table	82
#17 -- Sampling Design and Rationale.....	83
#18 -- Sampling Locations and Methods/SOP Requirements Table	86
#19 -- Analytical SOP Requirements Table.....	92
#20 -- Field QC Sample Summary Tables	93
#21 -- Project Sampling SOP References Table.....	94
#22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table.....	96
#23 -- Analytical SOP References Table.....	97
#24 -- Analytical Instrument Calibration Table	99
#25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	106
#26 -- Sample Handling System.....	107
#27 -- Sample Custody Requirements Table	108
#28 -- Laboratory QC Samples Table	112
#29 -- Project Documents and Records Table	121
#30 -- Analytical Services Table	122
#31 -- Planned Project Assessments Table	123
#32 -- Assessment Findings and Corrective Action Responses Table	124
#33 -- QA Management Reports Table	125
#34 -- Verification (Step I) Process Table	126
#35 -- Validation (Steps IIa and IIb) Process Table	128
#36 -- Analytical Data Validation (Steps IIa and IIb) Summary Table.....	130
#37 -- Usability Assessment.....	131
References.....	134

FIGURES

<u>NUMBER</u>		<u>PAGE</u>
ES-1	PSC 38 Site Location Map	5
10-1	General Location Map	39
10-2	Aerial Site Photograph	40
10-3	Generic Site Model.....	41
17-1	Proposed Groundwater and Soil Sampling Locations	85

APPENDICES

A	Sampling Event Report
B	NAS Jacksonville Background Data PALs for Metals
C	Field SOPs and Field Forms
D	Laboratory DoD ELAP Accreditation / FDOH Certification

ACRONYMS AND ABBREVIATIONS

°C	Degree Celsius
%D	Percent Difference or Percent Drift
%R	Percent Recovery
%RSD	Percent Relative Standard Deviation
ABB-ES	ABB Environmental Services, Inc.
ATSDR	Agency for Toxic Substances and Disease Registry
B&R	Brown and Root, Environmental
BEI	Bechtel Environmental, Inc.
BFB	Bromofluorobenzene
bgs	below ground surface
BHC	Benzene Hexachloride
CAS	Chemical Abstracts Service
CCB	Continuing Calibration Blank
CCC	Calibration Check Compound
CCV	Continuing Calibration Verification
CH2M Hill	CH2M Hill Constructors, Inc.
CLEAN	Comprehensive Long-term Environmental Action Navy
CLP	Contract Laboratory Program
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
CTL	Cleanup Target Level
CTO	Contract Task Order
CV	Comparison Value
CVAA	Cold Vapor Atomic Absorption
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DL	Detection Limit
DoD	Department of Defense
DPT	Direct-Push Technology
DQO	Data Quality Objective
DVM	Data Validation Manager
EDD	Electronic Data Deliverable
EECA	Engineering Evaluation and Cost Analysis
ELAP	Environmental Laboratory Accreditation Program

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Empirical	Empirical Laboratories, LLC
Ext.	Extension
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FOL	Field Operations Leader
FRE	Focused Risk Evaluation
FS	Feasibility Study
FTMR	Field Task Modification Request
g	Gram
G&M	Geraghty and Miller, Inc.
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatograph/Mass Spectrometer
GCTL	Groundwater Cleanup Target Level
GPS	Global Positioning System
Hart	Fred C. Hart Associates, Inc.
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HLA	Harding Lawson Associates
HSM	Health and Safety Manager
IAS	Initial Assessment Study
ICAL	Initial Calibration
ICB	Initial Calibration Blank
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectroscopy
ICS	Interference Check Standard
ICV	Initial Calibration Verification
ID	Identification
IDQTF	Interagency Data Quality Task Force
IDW	Investigation-Derived Waste
IRA	Interim Removal Action
IRP	Installation Restoration Program
IS	Internal Standard
L	Liter
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate

ACRONYMS AND ABBREVIATIONS (CONTINUED)

LOD	Limit of Detection
LOQ	Limit of Quantitation
MCL	Maximum Contaminant Level
mg/kg	Milligram per Kilogram
mL	Milliliter
MPC	Measurement Performance Criterion
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	Not Applicable
NAS	Naval Air Station
NAVFAC SE	Naval Facilities Engineering Command Southeast
ND	Non-Detect
NFA	No Further Action
oz	Ounce
PAH	Polycyclic Aromatic Hydrocarbon
PAL	Project Action Limit
Partnering Team	NAS Jacksonville Partnering Team
PCB	Polychlorinated Biphenyl
PHA	Public Health Assessment
PID	Photoionization Detector
PM	Project Manager
POC	Point of Contact
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
PSC	Potential Source of Contamination
PWD	Public Works Department
QA	Quality Assurance
QAM	Quality Assurance Manager
QC	Quality Control
QSM	Quality Systems Manual
r	Linear Regression Correlation Coefficient
r^2	Coefficient of Determination
RAC	Remedial Action Contract
RF	Response Factor
RI	Remedial Investigation
RPD	Relative Percent Difference

ACRONYMS AND ABBREVIATIONS (CONTINUED)

RPM	Remedial Project Manager
RRT	Relative Retention Time
RSL	Regional Screening Level
RT	Retention Time
SAP	Sampling and Analysis Plan
SCTL	Soil Cleanup Target Level
SCTL-LCH	Leachability Based on Groundwater Criteria
SCTL-RES	Residential Direct Exposure
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
SPCC	System Performance Check Compound
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBD	To Be Determined
TCL	Target Compound List
Tetra Tech	Tetra Tech NUS, Inc.
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
UFP-SAP	Uniform Federal Policy Sampling and Analysis Plan
µg/L	Microgram per Liter
USEPA	United States Environmental Protection Agency
USEPA-RES	USEPA Regions 3, 6, and 9 Regional Screening Level for Residential Soil
USEPA-RISK	Risk-Based Migration to Groundwater Soil Screening Level
USEPA-TAP	USEPA Regions 3, 6, and 9 Regional Screening Level for Tapwater
USGS	United States Geological Service
UST	Underground Storage Tank
VOC	Volatile Organic Compound

SAP Worksheet #2 -- SAP Identifying Information
 (UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Potential Source of Contamination (PSC) 38
Contractor Name: Tetra Tech NUS, Inc. (Tetra Tech)
Contract Number: N62470-08-D-1001
Contract Title: Comprehensive Long-term Environmental Action Navy (CLEAN)
Work Assignment Number: Contract Task Order (CTO) JM19

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (IDQTF, 2005) and the United States Environmental Protection Agency (USEPA) *Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS* (USEPA, 2002a).

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as reauthorized by Superfund Amendments and Reauthorization Act.

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Data Quality Objective (DQO) Scoping Meetings (Partnering Team)	February 9 and 10, 2010

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Initial Assessment Study, Naval Air Station Jacksonville, Jacksonville, Florida	March 1983
Naval Installation Restoration Program Plan, Volume 1 – Organization and Planning, Naval Air Station Jacksonville, Jacksonville, Florida	September 1991
Sampling Event Report, Potential Source of Contamination 38, Torpedo Rework Facility, Naval Air Station Jacksonville, Jacksonville, Florida	April 1999
Naval Installation Restoration Program Plan, Volume 2, Appendix D	June 1999

6. List organizational partners (stakeholders) and connection with lead organization:

Florida Department of Environmental Protection (FDEP) (regulatory stakeholder)
USEPA Region 4 (regulatory stakeholder)
Naval Air Station (NAS) Jacksonville (property owner)

7. Lead organization

Naval Facilities Engineering Command Southeast (NAVFAC SE)

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

Not Applicable (NA), as there are no exclusions.

SAP Worksheet #3 – Distribution List
(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address
Adrienne Wilson	Navy Remedial Project Manager (RPM)/ Manages Project Activities for the Navy	Code OPDE3/AW Department of the Navy Naval Facilities Southeast Attn: Ajax Street, Building 135N P.O. Box 30A Jacksonville, FL 32212-0030	(904) 542-6160	Adrienne.Wilson@navy.mil
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David Grabka	FDEP RPM/ Provides Regulator Input	FDEP 2600 Blair Stone Road, MS 4535 Tallahassee, FL 32399-2400	(850) 245-8997	david.grabka@dep.state.fl.us
Peter Dao	USEPA RPM/ Provides Regulator Input	USEPA Region 4 Atlanta Federal Center 61 Forsyth Street, SW Atlanta, GA 30303-8960	(404) 562-8508	dao.peter@epa.gov
John Trepanowski (copy of cover letter only)	Tetra Tech Program Manager / Manages Navy Initiatives	Tetra Tech 234 Mall Boulevard Suite 260 King of Prussia, PA 19406	(610) 382-1532	john.trepanowski@tetrattech.com

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address
Garth Glenn (copy of cover letter only)	Deputy Program Manager/ Manages Program Activities	Tetra Tech 5700 Lake Wright Drive Suite 309 Norfolk, VA 23502	(757) 461-3926	garth.glenn@tetrattech.com
Mark Peterson	Project Manager (PM)/ Manages Project Activities	Tetra Tech 8640 Philips Hwy, Suite 16 Jacksonville, FL 32256	(904) 730-4669 Extension (Ext.) 213	mark.peterson@tetrattech.com
Alan Pate	Field Operations Leader (FOL) / Site Safety Officer (SSO)/ Manages Field Operation and Site Safety Issues	Tetra Tech 8640 Philips Hwy, Suite 16 Jacksonville, FL 32256	(904) 730-4669 Ext. 214	alan.pate@tetrattech.com
Tom Johnston, PhD (electronic copy only)	Quality Assurance Manager (QAM)/ Manages Corporate Quality Assurance (QA) Program and Implementation	Tetra Tech 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412) 921-8615	tom.johnston@tetrattech.com
Peggy Churchill (electronic copy only)	Environmental Scientist/ Provides DQO and SAP Support	Tetra Tech 11 Riverside Drive, Suite 206 Cocoa, FL 32922	(321) 636-6470	peggy.churchill@tetrattech.com
Matt Soltis [Health and Safety Plan (HASP) only]	Health and Safety Manager (HSM)/ Manages Corporate Health and Safety Program	Tetra Tech 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412) 921-8912	matt.soltis@tetrattech.com

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address
Shauna Stotler-Hardy (electronic copy only)	Project Chemist/ Provides Coordination with Laboratory	Tetra Tech 900 Trail Ridge Road Aiken, SC 29803	(803) 641-4944	shauna.stotlerhardy@tetrattech.com
Joseph Samchuck (electronic copy only)	Data Validation Manager (DVM)/ Manages Data Validation	Tetra Tech 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412) 921-8510	joseph.samchuck@tetrattech.com
Lee Leck (electronic copy only)	Data Manager/ Manages Databases	Tetra Tech 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	(412) 921-8856	lee.leck@tetrattech.com
Julie Johnson	Administrative Project Assistant (NAS Jacksonville Administrative Record)	Tetra Tech 8640 Philips Hwy, Suite 16 Jacksonville, FL 32256	(904) 730-4669 Ext. 224	julie.johnson@tetrattech.com
Kim Kostzer (electronic copy only)	Laboratory PM/ Representative for Laboratory and Analytical Issues	Empirical Laboratories, LLC (Empirical) 621 Mainstream Drive, Suite 270 Nashville, TN 37228	(615) 345-1115	kkostzer@empirlabs.com
Well Installation and Direct-Push Technology (DPT) Driller(s) (TBD) (electronic copy only)	Subcontractor PM/ Provides Drilling Services	TBD	TBD	TBD
Utility Locator (electronic copy only)	Subcontractor PM/ Provides Utility Locating Services	TBD	TBD	TBD

SAP Worksheet #4 -- Project Personnel Sign-Off Sheet
(UFP-QAPP Manual Section 2.3.2)

Certification that project personnel have read the text will be obtained by one of the following methods as applicable:

1. In the case of regulatory agency personnel with oversight authority, approval letters or e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters / e-mails will be retained in the project files and are listed in Worksheet #29 as project records.
2. E-mails will be sent to the Navy, Tetra Tech, and subcontractor project personnel who will be requested to verify by e-mail that they have read the applicable SAP / sections and the date on which they were reviewed. Copies of the verification e-mail will be included in the project files and is identified in Worksheet #29.

A copy of the signed Worksheet #4 will be retained in the project files and is identified as a project document in Worksheet #29.

Name	Organization/Title/Role	Telephone Number	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Navy and Regulator Partnering Team Personnel					
Adrienne Wilson	Navy/ RPM/ Manages Project Activities for the Navy	(904) 542-6160	See Worksheet #1 for signature	All	
Tim Curtin	Navy/ IRP Manager/ NAS Jacksonville POC	(904) 542-4228		All	
David Grabka	FDEP/ RPM/ Provides Regulator Input	(850) 245-8997	See Worksheet #1 for signature	All	
Peter Dao	USEPA Region 4/ RPM/ Provides Regulator Input	(404) 562-8508	See Worksheet #1 for signature	All	

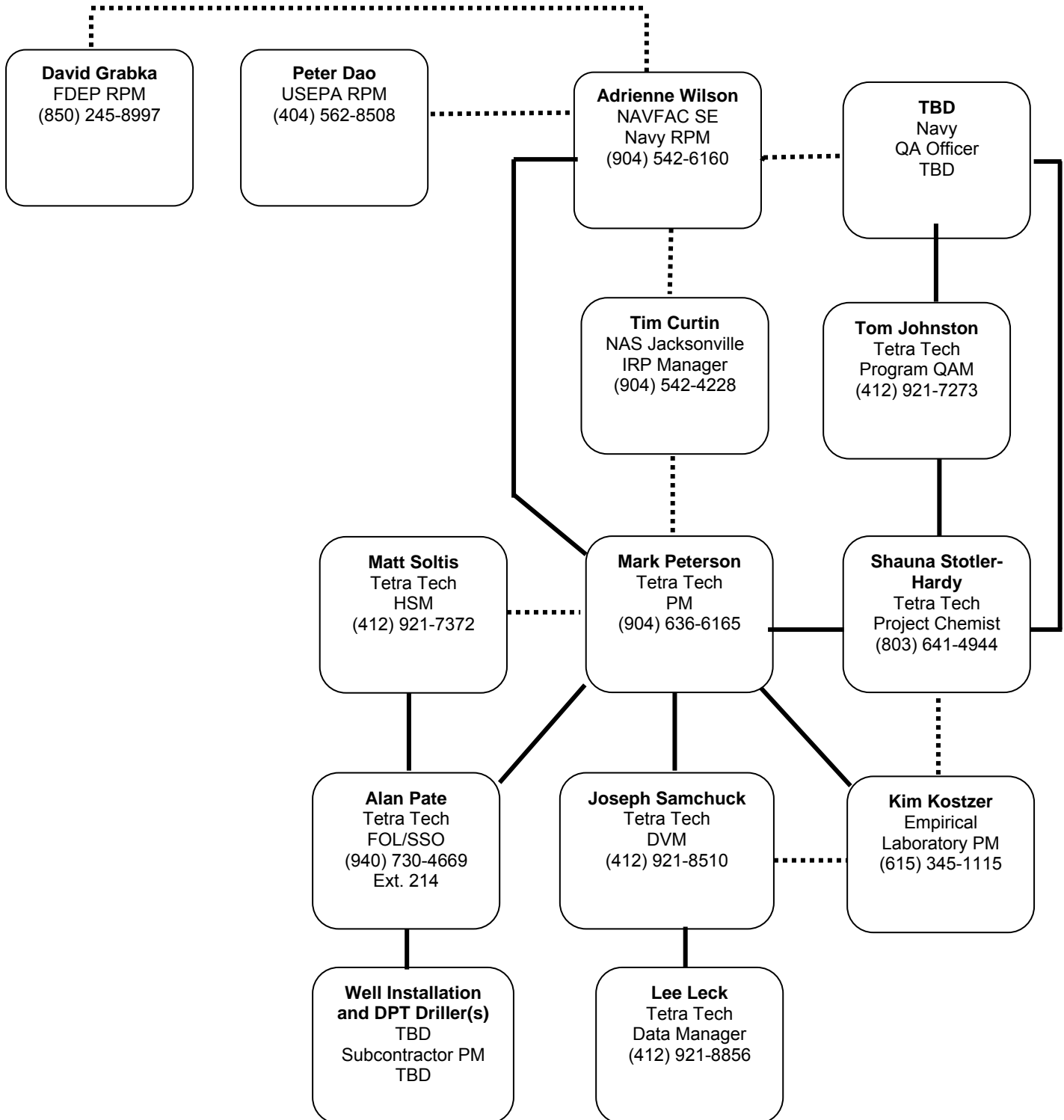
Name	Organization/Title/Role	Telephone Number	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Tetra Tech Partnering Team Personnel					
Mark Peterson	Tetra Tech/ PM/ Manages Project Activities	(904) 730-4669 Ext. 213	See Worksheet #1 for signature	All	
Alan Pate	Tetra Tech/ FOL/SSO/ Manages Field Operation and Site Safety Issues	(904) 730-4669 Ext. 214		All	
Tom Johnston	Tetra Tech/ QAM/ Manages NAVFAC SE Contract QA Program and Implementation	(412) 921-8615	See Worksheet #1 for signature	All	
Matt Soltis	Tetra Tech/ HSM/ Manages Corporate Health and Safety Program	(412) 921-8912	See HASP for signature	HASP	
Peggy Churchill	Tetra Tech/ Environmental Scientist/ Provides DQO and SAP Support	(321) 636-6470		All	
Shauna Stotler-Hardy	Tetra Tech/ Project Chemist/ Provides Coordination with Laboratory	(803) 641-4944		All	
Joseph Samchuck	Tetra Tech/ DVM/ Manages Data Validation	(412) 921-8510		Worksheets #12, #14, #15, #19, #20, #23-28, #30, and #34-37	
Lee Leck	Tetra Tech/ Data Manager/ Manages Databases	(412) 921-8856		Worksheets #12, #14, #15, #19, #20, #23-28, #30, and #34-37	

Name	Organization/Title/Role	Telephone Number	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Subcontractor Personnel					
Kim Kostzer	Empirical/ Laboratory PM/ Representative for Laboratory and Analytical Issues	(615) 345-1115		Worksheets #6, #12, #14, #15, #19, #23- 28, #30, and #34-36	
Driller(s) - TBD	TBD/ DPT and Well Installation Subcontractor PM/ Provides Drilling Services	TBD		Worksheets #6, #14, #17, and Figures	
Utility Locator - TBD	TBD/ Utility Locator Subcontractor PM/ Provides Utility Locating Services	TBD		Worksheets #6, #14, #17, and Figures	

SAP Worksheet #5 – Project Organizational Chart
 (UFP-QAPP Manual Section 2.4.1)

Lines of Authority —————

..... Lines of Communication



SAP Worksheet #6 -- Communication Pathways
 (UFP-QAPP Manual Section 2.4.2)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure (timing, pathway to & from, etc.)
SAP amendments	Tetra Tech FOL/SSO Tetra Tech PM Navy RPM	Alan Pate Mark Peterson Adrienne Wilson	(904) 730-4669 Ext. 214 (904) 730-4669 Ext. 213 (904) 542-6160	<p>The Tetra Tech FOL will verbally inform the Tetra Tech PM within 24 hours of realizing a need for an amendment.</p> <p>The Tetra Tech PM will document the proposed changes via a Field Task Modification Request (FTMR) form within 5 days and send the Navy RPM a concurrence letter within 7 days of identifying the need for change.</p> <p>SAP amendments will be submitted by the Tetra Tech PM to the Navy RPM for review and approval. The Navy RPM will notify the regulators by mail of changes to the SAP.</p> <p>The Tetra Tech PM will send scope changes to the Partnering Team via e-mail within 1 business day.</p>
Changes in schedule	Tetra Tech PM Navy RPM NAS Jacksonville POC	Mark Peterson Adrienne Wilson Tim Curtin	(904) 730-4669 Ext. 213 (904) 542-6160 (904) 542-4228	The Tetra Tech PM will verbally inform the Navy RPM and the NAS Jacksonville POC on the day that schedule change is known and document via schedule impact letter within 1 business day of when impact is realized.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure (timing, pathway to & from, etc.)
Issues in the field that lead to changes in the scope of work	Tetra Tech FOL/SSO Tetra Tech PM Navy RPM NAS Jacksonville POC	Alan Pate Mark Peterson Adrienne Wilson Tim Curtin	(904) 730-4669 Ext. 214 (904) 730-4669 Ext. 213 (904) 542-6160 (904) 542-4228	<p>The Tetra Tech FOL will verbally inform the Tetra Tech PM on the day that the issue is discovered.</p> <p>The Tetra Tech PM will inform the Navy RPM and the NAS Jacksonville POC (verbally or via e-mail) within 1 business day of discovery.</p> <p>The Navy RPM will issue scope change (verbally or via e-mail), if warranted. The scope change is to be implemented before further work is executed.</p> <p>The Tetra Tech PM will document the change via an FTMR form within 2 days of identifying the need for change and will obtain required approvals within 5 days of initiating the form.</p>
Recommendation to stop work and initiate work upon corrective action	Tetra Tech FOL/SSO Tetra Tech PM Tetra Tech QAM Tetra Tech HSM Tetra Tech Project Chemist Navy RPM NAS Jacksonville POC	Alan Pate Mark Peterson Tom Johnston Matt Soltis Shauna Stotler-Hardy Adrienne Wilson Tim Curtin	(904) 730-4669 Ext. 214 (904) 730-4669 Ext. 213 (412) 921-8615 (412) 921-8912 (803) 641-4944 (904) 542-6160 (904) 542-4228	<p>If Tetra Tech is the responsible party for a stop work command, the Tetra Tech FOL will inform on-site personnel, subcontractor(s), the NAS Jacksonville POC, and the identified Partnering Team members within 1 hour (verbally or by e-mail).</p> <p>If a subcontractor is the responsible party, the subcontractor PM must inform the Tetra Tech FOL within 15 minutes, and the Tetra Tech FOL will then follow the procedure listed above.</p>

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure (timing, pathway to & from, etc.)
Corrective action for field program	Tetra Tech QAM Tetra Tech PM Navy RPM	Tom Johnston Mark Peterson Adrienne Wilson	(412) 921-8615 (904) 730-4669 Ext. 213 (904) 542-6160	The Tetra Tech QAM will notify the Tetra Tech PM verbally or by e-mail within 1 business day that the corrective action has been completed. The Tetra Tech PM will then notify the Navy RPM (verbally or by e-mail) within 1 business day.
Field data quality issues	Tetra Tech FOL/SSO Tetra Tech PM	Alan Pate Mark Peterson	(904) 730-4669 Ext. 214 (904) 730-4669 Ext. 213	The Tetra Tech FOL will inform the Tetra Tech PM (verbally or by e-mail) on the same day that a field data quality issue is discovered.
Analytical data quality issues	Laboratory PM Tetra Tech Project Chemist Tetra Tech PM Navy RPM	Kim Kostzer Shauna Stotler-Hardy Mark Peterson Adrienne Wilson	(615) 345-1115 (803) 641-4944 (904) 730-4669 Ext. 213 (904) 542-6160	The Laboratory PM will notify (verbally or via e-mail) the Tetra Tech Project Chemist within one business day of when an issue related to laboratory data is discovered. The Tetra Tech Project Chemist will notify (verbally or via e-mail) the data validation staff and the Tetra Tech PM within one business day. Tetra Tech DVM or Project Chemist notifies Tetra Tech PM verbally or via e-mail within 48 hrs of validation completion that a non-routine and significant laboratory quality deficiency has been detected that could affect this project and/or other projects. The Tetra Tech PM verbally advises the NAVFAC RPM within 24 hours of notification from the project chemist or DVM. The NAVFAC RPM takes corrective action that is appropriate for the identified deficiency. Examples of significant laboratory deficiencies include data reported that has a corresponding failed tune or initial calibration verification. Corrective actions may include a consult with the NAVFAC Navy Chemist.

SAP Worksheet #7 – Responsibilities and Qualifications Table
(UFP-QAPP Manual Section 2.4.3)

The personnel responsible for implementing the SAP are identified in the following table. Resumes are available upon request.

Name	Title/Role	Organizational Affiliation	Responsibilities
Adrienne Wilson	Navy RPM/ Manages project activities for the Navy	NAVFAC SE	Oversees project implementation including scoping, data review, and evaluation.
Tim Curtin	IRP Manager/ Manages daily site activities related to this project	NAS Jacksonville	Oversees site activities and participates in scoping, data review, evaluation, and reviews the SAP.
David Grabka	RPM/ Provides regulator input	FDEP	Participates in scoping, data review, evaluation, and approves the SAP.
Peter Dao	RPM/ Provides regulator input	USEPA Region 4	Participates in scoping, data review, evaluation, and approves the SAP.
Mark Peterson	PM/ Manages project on a daily basis	Tetra Tech	Oversees project and manages financial, schedule, and technical day-to-day activities of the project.
Alan Pate	FOL/SSO Manages field operations and oversees site activities to ensure safety requirements are met	Tetra Tech	As FOL, supervises, coordinates, and performs field sampling activities. As the SSO, is responsible for on-site project-specific health and safety training and monitoring site conditions. Details of these responsibilities are presented in the HASP.
Tom Johnston	QAM/ Oversees program and project QA activities	Tetra Tech	Reviews the SAP and ensures quality aspects of the CLEAN program are implemented, documented, and maintained.

Name	Title/Role	Organizational Affiliation	Responsibilities
Matt Soltis	HSM/ Oversees health and safety activities	Tetra Tech	Oversees CLEAN Program Health and Safety Program.
Shauna Stotler-Hardy	Project Chemist/ Conducts data validation and reporting	Tetra Tech	Participates in project scoping, prepares laboratory scopes of work, and coordinates laboratory-related functions with laboratory. Oversees data quality reviews and QA of data validation deliverables.
Joseph Samchuck	DVM/ Oversees data validation activities	Tetra Tech	Manages data validation activities within Tetra Tech, including ensuring QA of data validation deliverables, providing technical advice on data usability, and coordinating and maintaining the data validation review schedule.
Lee Leck	Data Manager/ Oversees database activities	Tetra Tech	Manages Tetra Tech databases and ensures input of data.
Kim Kostzer	Laboratory PM/ Representative for Laboratory and Analytical Issues	Empirical	Coordinates analyses with laboratory chemists, ensures that scope of work is followed, provides QA of data packages, and communicates with Tetra Tech project staff.
TBD	Driller(s)	TBD	Performs DPT soil borings and well installations according to scope of work.
TBD	Utility Locator	TBD	Performs utility location.

In some cases, one person may be designated responsibilities for more than one position. For example, the FOL will be responsible for SSO duties. This action will be performed only as credentials, experience, and availability permits.

SAP Worksheet #8 -- Special Personnel Training Requirements Table
(UFP-QAPP Manual Section 2.4.4)

Each site worker will be required to have completed a 40-hour course (and 8-hour refresher, if applicable) in Health and Safety Training as described under Occupational Safety and Health Administration 29 Code of Federal Regulations 1910.120(b)(4). Safety requirements are addressed in greater detail in the site-specific Tetra Tech HASP.

SAP Worksheet #9 – Internal Project Scoping Session Participants Sheet
 (UFP-QAPP Manual Section 2.5.1)

Project Name: NAS Jacksonville Projected Date(s) of Sampling: August 2011 Project Manager: Mark Peterson		Site Name: PSC 38 Site Location: NAS Jacksonville, Florida			
Date of Session: April 20-21, 2010 Scoping Session Purpose: DQO Development					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Peter Dao	USEPA RPM	USEPA	(404) 562-8508	Dao.Peter@epa.gov	USEPA RPM
Hal Davis	Geologist	United States Geological Survey (USGS)	(850) 553-3673	hdavis@usgs.gov	USGS Geologist
Casey Hudson	Remedial Action Contract (RAC) Contractor	CH2M Hill Constructors, Inc. (CH2M Hill)	(770) 604-9182 Ext. 54172	Casey.Hudson@ch2m.com	RAC Contractor
Gus Campana	Facilitator	The Management Edge	(407) 352-3687	gusbell@earthlink.net	Facilitator
Adrienne Wilson	Navy RPM	NAVFAC SE	(904) 542-6160	Adrienne.Wilson@navy.mil	Navy RPM
Tim Curtin	IRP Manager NAS Jacksonville	NAVFAC SE	(904) 542-4228	Tim.L.Curtin@navy.mil	IRP Manager
David Grabka	Federal Facilities RPM	FDEP	(850) 245-8997	David.Grabka@dep.state.fl.us	FDEP RPM
Eric Davis	RAC Contractor	CH2M Hill	(678) 530-4085	Eric.Davis@ch2m.com	RAC Contractor
Mark Peterson	PM	Tetra Tech	(904) 730-4669 Ext. 213	Mark.Peterson@tetrattech.com	PM
Mike Maughon	Senior Environmental Engineer	Tetra Tech	(843) 886-4547	Mike.Maughon@tetrattech.com	Technical Support: Assessment, Regulatory Compliance, and Remediation
Alan Pate	FOL/SSO	Tetra Tech	(904) 730-4669 Ext. 214	Alan.Pate@tetrattech.com	Project Support
Julie Johnson	Administrative Project Assistant III	Tetra Tech	(904) 730-4669 Ext. 224	Julie.Johnson@tetrattech.com	Scribe

Comments/Decisions: The DQO process was presented and the following was discussed:

1. DQO Discussion

- Delineate the levels and extent of contaminants in surface and subsurface soil associated with sumps, disposal pits, and underground storage tank (UST) facilities. Delineate the source, nature, and extent of previously detected groundwater contamination.
- Project target analytes will include target compound list (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL polychlorinated biphenyls (PCBs), TCL pesticides, and target analyte list (TAL) metals. The plan is to collect surface soil, subsurface soil, and groundwater samples. Surface solid material in ditches will be treated as soil.

2. Consensus Decision

- Treat drainage swale soil as soil rather than sediment for purposes of screening against FDEP Soil Cleanup Target Levels (SCTLs). Sampling will be conducted in the ditch.

3. Action Item

- Material Safety Data Sheet for Otto Fuel II needs to be researched to determine the appropriate analytes for inclusion in the SAP.

4. Action Taken

- Otto Fuel II (Chemical Abstracts Service [CAS] Registry Number 6423-43-4), is a monopropellant that is used as a fuel for torpedoes, and is made up of approximately 75% propylene glycol dinitrate, 23% dibutyl sebacate, and 2% 2-nitrodiphenylamine.

Note: After review of this work plan, David Grabka, FDEP stated that propylene glycol dinitrate should be added to the list of analytes, due to lack of information available documenting historical activities. Propylene glycol dinitrate will be added to the list of COCs and analyzed at six locations in soil and groundwater through a Field Task Modification.

Action Items:

- Tetra Tech was assigned the task to prepare the Work Plans for a Remedial Investigation (RI)/Feasibility Study (FS) at PSC 38. The scope of this Phase I RI is to investigate the potential for unacceptable levels of contamination from the identified target analytes in surface soil, subsurface soil, and groundwater at PSC 38.

Based on the results of the Phase I RI, the Partnering Team will decide if it is necessary to conduct additional phases of remedial investigation to (a) determine the full nature and extent of soil and/or

groundwater contaminants at PSC 38; (b) perform a Human Health Risk Assessment (HHRA) to evaluate the potential risk to human receptors caused by the release of contaminants at or from PSC 38 (c) evaluate if an Engineering Evaluation and Cost Analysis (EECA) will be performed to remove impacted media; and (d) prepare the FS based on the data from the RI and the HHRA.

SAP Worksheet #10 – Conceptual Site Model **(UFP-QAPP Manual Section 2.5.2)**

This worksheet presents general background information about PSC 38 and the conceptual site model (CSM) that describes potential contamination routes and possible exposure pathways to humans and to ecological receptors. The CSM serves as the basis for developing the sampling and analysis program.

10.1 INTRODUCTION

NAS Jacksonville was commissioned in October 1940 to provide facilities for air operations and pilot training and a Navy Aviation Trades School for ground crewmen. The facility is located in Duval County, Florida on the western bank of the St. Johns River (see Figure 10-1). The facility is approximately 3,800 acres in size, and its current mission is to provide facilities and support for the operation and maintenance of naval weapons and aircraft.

The main portion of NAS Jacksonville is bordered to the north by the Timuquana Country Club, to the east and northeast by the St. Johns River, to the south by a residential area, and to the west by Highway 17 with Westside Regional Park and commercial developments. The facility is located approximately 24 miles inland from the Atlantic Ocean.

NAS Jacksonville is home to Patrol Squadron Thirty (VP-30), the Navy's largest aviation squadron and the only P-3 Orion Fleet Replacement Squadron that prepares and trains U.S. and foreign pilots, air crew, and maintenance personnel for further operational assignments. Support facilities include an airfield for pilot training, a maintenance depot employing more than 150 different trade skills capable of performing maintenance as basic as changing a tire to intricate micro-electronics or total engine disassembly, a naval hospital, a Fleet Industrial Supply Center, and a Navy Family Service Center.

Work in support of the base mission includes fuel storage and transportation systems and the overhaul, intermediate maintenance, and repair of aircraft and engines. Maintenance activities at NAS Jacksonville over the years generated a variety of materials, of which some were disposed of on the base. These include materials resulting from construction activities; municipal solid waste and municipal wastewater treatment plant sludge; and miscellaneous industrial wastes including waste oils or solvents, paints, and spilled fuels. Current disposal practices are regularly surveyed for conformity to local, state, and federal regulations.

10.2 SITE DESCRIPTION

PSC 38, the Torpedo Rework Facility, encompasses approximately 2.5 acres within the restricted Magazine Area in the central-western portion of NAS Jacksonville. The site is surrounded by an 8-foot high fence and is accessible from Allegheny Road via a paved driveway, but access is limited to Navy personnel with weapons clearance. There are three buildings within PSC 38: Building 327, the Torpedo Rework Facility; Building 367, the Bulk Waste Storage Area; and Building 330, a storage building for paint and hazardous materials. An aerial photograph of PSC 38 that shows the building locations and the surrounding area is presented on Figure 10-2.

In general, the topography at PSC 38 is flat and gently slopes to the south and east. An unlined ditch parallels the eastern and southern boundaries of PSC 38 and then flows westward under Allegheny Road. Surface drainage eventually discharges into the tributaries of the Ortega River, which is located about 1 mile west of PSC 38.

Work in support of the base mission that is carried out at PSC 38 includes the repair and cleaning of propulsion systems, the addition of Otto fuel to torpedoes, and inspection of torpedoes. A variety of materials are used as part of the maintenance and support activities at PSC 38, which resulted in chemical releases to the environment.

Specifically, processes for reworking torpedoes generated approximately one 55-gallon drum of solid waste material per day (gloves and rags containing Otto fuel). Additionally, unmonitored USTs, lead acid battery disposal areas, and gravel sumps may have contributed contaminants to the site (Hart, 1983, as referenced in HLA, 1999).

10.3 PREVIOUS INVESTIGATIONS

1983 - The Torpedo Rework Facility was identified as a PSC during the Initial Assessment Study (IAS) (Hart, 1983, as referenced in HLA, 1999). During IAS interviews, personnel stated that the processes associated with reworking torpedoes generated approximately one 55-gallon drum of solid waste material (gloves and rags containing Otto fuel) at the facility per day. Personnel further indicated that drums containing wastes had always been disposed of off-site. Because no wastes were disposed of on-site and no releases of Otto fuel were documented, the IAS report did not recommend a confirmation study for PSC 38.

1991 - Geraghty and Miller, Inc. (G&M) later discovered that unmonitored USTs might be present at PSC 38 (G&M, 1991). In addition to these USTs, the report mentioned two gravel sumps on the east side of Building 327 that may have received waste. The exact locations of these sumps were not provided.

Volume 1 of the Navy IRP Plan recommended site screening to determine if leakage from the gravel sumps had contaminated soil or groundwater in the vicinity of PSC 38. However, no sampling was conducted at that time.

1994 - During the PSC reconnaissance, ABB Environmental Services, Inc. (ABB-ES) observed fill ports for two USTs, confirming the presence of the two USTs noted previously by G&M. NAS Jacksonville personnel confirmed that one tank was installed in 1958 and held 350 gallons of diesel fuel for an emergency generator and the second tank was a 1,000-gallon steel heating oil UST that was no longer in use. No records of tightness testing for either UST were available. ABB-ES observed dead grass around the fill port of the diesel fuel UST during the PSC reconnaissance, indicating that diesel fuel may have spilled or overflowed.

ABB-ES found several maps showing a below-grade acid pit on the east side of Building 327. This pit is believed to have functioned as a disposal area for lead battery acid; however, its presence has not been confirmed. A septic tank was also identified on a facility utility map that was connected to sanitary facilities inside Building 327. ABB-ES also observed a 3-by-6-foot concrete-bermed gravel drain on the west side of Building 330. Facility employees did not know its function and could not confirm it as a drain. No evidence of contamination, such as stained soil, odor, or stressed vegetation, was observed around the gravel drain (ABB-ES, 1995).

1996 - In February 1996, Brown and Root Environmental (B&R) collected three surface soil samples for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, and TAL inorganics (metals and cyanide). The three sample locations were selected in areas of suspected contamination: (1) within stained soil and stressed vegetation near the diesel fuel UST port (sample SS-1); (2) within the area of sparse vegetation at the southeast corner of Building 327 (sample SS-2); and (3) near the gravel drain adjacent to the doorway of Building 330 (sample SS-3) (B&R, 1996). No organic chemicals were detected above FDEP SCTLs; however, several metals were detected in each sample. Of particular interest, the concentrations of arsenic, chromium, and copper slightly exceeded background levels in SS-2; and the concentrations of antimony, arsenic, beryllium, cadmium, chromium, lead, and zinc exceeded their respective SCTLs for residential areas in SS-3.

1997 to 1999 - Support facilities such as USTs, a below-grade acid pit, a hazardous materials and paint storage area, gravel sumps, and a concrete-bermed gravel drain were determined to be areas of interest and were the focus of a 1997 site investigation by Harding Lawson Associates (HLA). HLA collected soil samples from nine different locations at PSC 38. Groundwater samples were also collected in downgradient locations. Surface water and sediment samples were collected from the unlined drainage ditch that surrounds the fenced in area of PSC 38. The samples were analyzed for TCL VOCs, TCL

SVOCs, TCL pesticides and PCBs, and TAL inorganics. The results of the 1997 sampling events and a summary of the previous site activities was documented in a Sampling Event Report (HLA, 1999), which is provided in Appendix A.

A total of 21 soil samples were collected by HLA. Four samples were collected to investigate an area of fill near the eastern fence line and an area of stressed vegetation east of the bulk waste storage area. Five samples were collected from the gravel sump areas on the eastern side of Building 327, and six soil samples were collected from around the gravel drain near the hazardous materials and paint storage building (Building 330). Also, two samples were collected from near the area of the former below grade acid pit, and two samples each were collected from near the bulk waste storage area (Building 367) and drainage field from septic tank No. 360.

One surface water and two sediment samples were collected from the unlined drainage ditch that parallels the eastern and southern side of the PSC. Surface water was present only at one of the sediment sample locations. Two "micro" monitoring wells were installed downgradient of the suspected source areas. Monitoring well MW001 was installed to a depth of 13 feet below ground surface (bgs) with 9 feet of screen and MW002 was installed to a depth of 12 feet bgs with 9 feet of screen.

The soil, surface water, sediment, and groundwater samples were collected and analyzed for TCL VOCs, SVOCs, pesticides, and PCBs, and TAL inorganics (metals and cyanide).

In Section 5.0 of that report, Risk Evaluation, HLA identified certain contaminants that significantly exceeded guidance and regulatory levels, including one surface soil sample immediately adjacent to one of the gravel sumps (38S00601) contained lead in excess of the then-current FDEP SCTL and one groundwater sample taken from the eastern side of PSC 38 (38G002) contained trichloroethene and its breakdown products 1,2-dichloroethene and vinyl chloride in excess of the FDEP Groundwater Cleanup Target Levels (GCTLs) and the Federal Maximum Contaminant Levels (MCLs).

Focused risk evaluations (FREs) were performed as part of the site screening evaluation to assist in determining whether or not the existing risk at a PSC (1) supports a no further action (NFA) decision, (2) indicates the need for an interim remedial action, or (3) requires additional investigation to make a decision. The documentation of the decision for PSC 38 may be found in the Remedial Response Decision System document for PSC 38 (ABB-ES, 1995). The FREs were not intended to characterize "baseline" risk at the PSC, but rather were used as a decision making tool.

It was not necessary to conduct a FRE to support the decision to perform an interim remedial action at one of the gravel sumps and to collect additional groundwater data because levels of certain contaminants significantly exceeded guidance and regulatory levels.

1999 - In June 1999, the Navy IRP Plan, Volume 2, Appendix D presented No Further Response Action Planned summaries for PSCs, including PSC 38. Additional pertinent site history identified in this report includes the following:

- 4/20/1998 – Site screening completed and an interim removal action (IRA) was recommended to address contamination at or near the gravel sump. Also, additional site characterization to determine the extent of groundwater contamination has been recommended and USEPA and FDEP concurred.
- 1/1999 – Bechtel Environmental, Inc. (BEI) excavated sumps and soil at the gravel sump area.
- 6/1/1999 – Regulators concurred to determine extent of contamination and the IRA.

2005 - In July 2005, the Agency for Toxic Substances and Disease Registry (ATSDR) completed a Public Health Assessment (PHA) for NAS Jacksonville, including all PSCs and Operable Units (ATSDR, 2005). The PHA identified a number of contaminants at PSC 38 with maximum concentrations exceeding their comparison value (CV), a risk-based screening value that ATSDR utilizes to support the PHA. The information on the concentrations exceeding their CV could not be verified. Therefore this information, when referenced herein, is included for the purpose of providing a complete document. Irreversible decisions should not be made based solely on these values. The PHA also described two gravel pits as “wet mop swab pits” that have been either covered or removed.

10.4 CONCEPTUAL SITE MODEL

The CSM for PSC 38 is described in the following sections and is visually depicted on Figure 10-3. The purpose of this investigation is to collect additional data to refine the CSM and prepare an RI/FS for PSC 38. As described in the following sections, there is limited historical data and significant uncertainty remains about the nature and extent of potential contamination at PSC 38.

10.4.1 Geology and Hydrogeology

In general, the surficial, shallow, or upper aquifer at NAS Jacksonville ranges from 10 to 90 feet in thickness and contains unconsolidated sediments that include clay, silt, sands, shelly sands, and shell beds. Documents suggest that the top of the surficial aquifer in some areas of NAS Jacksonville is 3 to 8 feet bgs, whereas the top of the surficial aquifer in other areas is approximately 15 to 35 feet bgs. At PSC 38, the top of the surficial aquifer is estimated to be 6 to 10 feet bgs based on historical site data.

Generally, groundwater in the surficial aquifer flows from high topography to low topography and toward surface water bodies, including north and east to the St. Johns River or in the west toward the Ortega River. Currently, groundwater in the surficial aquifer is not a water supply for NAS Jacksonville or the surrounding areas.

The intermediate Hawthorne aquifer in the NAS Jacksonville vicinity ranges from about 35 to 400 feet bgs, and the Floridan aquifer begins about 400 feet bgs and contains more than 1,000 feet of dolostone formations and limestone. Contaminants in groundwater at NAS Jacksonville historically have not been detected below about 60 feet bgs.

Surface water drainage at NAS Jacksonville is primarily associated with two main water bodies – the St. Johns River, which forms the eastern boundary of the station, and the Ortega River, located about ½ mile west of U.S. Highway 17. Surface water at PSC 38 drains indirectly into the Ortega River. NAS Jacksonville contains a complicated storm drainage system comprising numerous sewers, drainage ditches, and unnamed streams that manage water and discharge it off-site.

10.4.2 Nature and Extent of Contamination

Historical activities related to site operations at PSC 38 led to contamination in surface soil and other environmental site media. Chemical concentrations in soil and groundwater were identified during previous investigations of several potential source areas associated with PSC 38. However, neither the nature nor the extent of the contamination has been fully characterized. New data is required to determine the nature and extent of contamination at the potential source areas located at PSC 38.

There are several potential source areas associated with PSC 38 that have been investigated. These include the two USTs and the associated piping, the below-grade acid pit, and the 3-by-6 foot concrete bermed gravel drain. Target analytes released from these sources will enter the soil at a level that is below land surface. Since these potential sources are below land surface, which is covered with vegetation (i.e., lawn grass), there is little likelihood that surface soils that may contain target analytes. The target analytes can be leached from the subsurface soil and enter the groundwater through rainfall infiltration. Based upon the local topography, groundwater is expected to flow to the east and/or southeast, but groundwater on the west side of NAS Jacksonville typically flows toward west toward the Ortega River.

Spills and releases from general site activities at PSC 38 are the likely sources of contamination. The historical operations at the site and analytical results from previous site investigations indicate that limited releases have occurred directly onto the surface or indirectly into the subsurface via USTs or below-grade pits and potentially have migrated into site soil and groundwater. Previous limited analytical results

provide evidence that chlorinated organic solvents exist in groundwater and numerous metals exist in soil at the site, including elevated levels of lead near a gravel sump that was removed in 1999. Based on limited site operational data and historical analytical results, VOCs, SVOCs, pesticides, PCBs, and metals may have been released from processes at the site.

The Sampling Event Report documented that waste from PSC 38, the Torpedo Rework Facility, was disposed off-site and there were no documented releases of Otto Fuel II, which is a fuel for torpedo systems that is comprised of an energetic compound (propylene glycol dinitrate), a desensitizer (butyl sebacate), and a stabilizer (2-nitrodiphenylamine). According to the ATSDR document "Otto Fuel II and Its Components: ToxFAQs™", Otto Fuel II is a distinct-smelling, reddish-orange, oily liquid that enters the environment mainly in waste water from Naval facilities that produce it or are involved in torpedo operations. All three components can be broken down by microorganisms in soil and water, and propylene glycol dinitrate evaporates readily (ATSDR, 1996).

Following their review of the data contained in the Sampling Event Report, the Partnering Team decided that the nature of the contamination at PSC 38 had not been adequately determined, and they decided it was necessary to delineate the source, nature, and extent of the target analytes in shallow and subsurface soil and groundwater associated with the support facilities that are located at PSC 38. Since the nature of the contamination is not fully known, it is premature to only use compounds that were detected in previous samples at elevated levels as the target analytes for this Phase I RI. Therefore, the Partnering Team decided that it was necessary to analyze the Phase I RI samples for the full list of TCL VOCs, TCL SVOCs (including low level polycyclic aromatic hydrocarbons [PAHs]), TCL pesticides and PCBs, and TAL metals. The specific target analytes for PSC 38 are presented in Worksheet #15.

Soil

One of the surface soil samples (sample 38S00601, which was collected from immediately adjacent to the gravel sump at the southeastern corner of Building 327) contained lead at 2,350 milligrams per kilogram (mg/kg), which significantly exceeded the FDEP residential SCTL of 500 mg/kg and the industrial SCTL of 1,000 mg/kg (FDEP, 1995) (HLA, 1999). The gravel sump and soil around it was removed by BEI in 1999, but no confirmation samples are available to demonstrate that the removal action was complete.

The PHA identified the following contaminants in surface soil at levels above the CVs: arsenic (up to 3 mg/kg), barium (up to 4,350 mg/kg), cadmium (up to 29.4 mg/kg), chromium (up to 21,000 mg/kg), iron (up to 41,400 mg/kg), lead (up to 3,650 mg/kg), and zinc (up to 39,700 mg/kg). No contaminants were above CVs in subsurface soil or sediment (ATSDR, 2005). The information on the concentrations exceeding their CV could not be verified. Therefore this information, when referenced herein, is included

for the purpose of providing a complete document. Irreversible decisions should not be made based solely on these values.

Groundwater

The groundwater sample taken from the eastern side of PSC 38 (sample 38W002) contained trichloroethene and its breakdown products 1,2-dichloroethene and vinyl chloride at levels above the primary groundwater standards (the FDEP GCTLs and the Federal MCLs). Trichloroethene was detected at 24 micrograms per liter ($\mu\text{g/L}$) compared to 3 $\mu\text{g/L}$ (GCTL) and 5 $\mu\text{g/L}$ (MCL); vinyl chloride was detected at 57 $\mu\text{g/L}$ compared to 1 $\mu\text{g/L}$ (GCTL) and 2 $\mu\text{g/L}$ (MCL); and 1,2-dichloroethene was detected at 73 $\mu\text{g/L}$ compared to 70 $\mu\text{g/L}$ (GCTL and MCL) (HLA, 1999).

The PHA identified the following contaminants in groundwater at levels above the CVs: iron (up to 50,300 $\mu\text{g/L}$), total 1,2-dichloroethene (73 $\mu\text{g/L}$), trichloroethene (24 $\mu\text{g/L}$), and vinyl chloride (57 $\mu\text{g/L}$). No contaminants were detected above CVs for surface water (ATSDR, 2005). The information on the concentrations exceeding their CV could not be verified. Therefore this information, when referenced herein, is included for the purpose of providing a complete document. Irreversible decisions should not be made based solely on these values.

The top of the water table is likely intercepted by the drainage ditch at the border of PSC 38. Therefore, target analytes in the top of the water table are likely flowing into the drainage ditch. This surface water ultimately discharges into tributaries of the Ortega River. The groundwater that contains target analytes that flow under the drainage ditch eventually discharges into the St. Johns River, approximately 5,000 feet southeast of PSC 38. Ditches like the type installed at PSC 38 often serve two functions. One function is to intercept rainfall sheet-flow and the other function is to lower the water table surface by intercepting the groundwater flowing into an area. This lowering of the water table surface near installed features like gravel sumps and gravel drains enables these features to operate better.

10.4.3 Migration Pathways

People who work or live in the area of an environmental release can only be exposed to a contaminant if they come in contact with it. Exposure might occur by breathing, eating, or drinking a substance containing a contaminant or by skin contact with a substance containing the contaminant. Consequently, a release does not always result in exposure. Completed exposure pathways exist if all elements of a human exposure are present, while a potential pathway is one in which one or more of the pathway elements cannot be definitively proved or disproved. A pathway is eliminated from further evaluation if at least one element is absent.

Releases and potential releases to the soil may present complete exposure pathways to human receptors and/or serve as a source of contamination to groundwater and present complete exposure pathways to humans through those routes. Releases to site soil may act as contaminant reservoirs for migration to groundwater.

The potential for target analytes in groundwater to discharge to the surface water (i.e., the Ortega River or the St. Johns River) is dependent upon a number of factors. Three key factors are the concentration of the target analyte at the source (i.e. PSC 38), the distance from PSC 38 to the surface receptor, and the target analyte's dilution/attenuation factor. There are no verified data that suggest the target analytes are present at PSC 38 at concentrations that would represent a long-term continuing source of contamination. The closest surface water receptor (the St. Johns River) is approximately one-mile from the PSC 38. Based upon current understanding of the geology and the physical-chemistry of the target analytes, it is believed that dilution/attenuation factors, for many target analytes, are relatively high. These three site-specific factors suggest that there is a low potential for target analytes to discharge into the Ortega River or the St. Johns River. Therefore, the groundwater to surface water migration potential will not be evaluated in the Phase I RI. If concentrations of target analytes are detected (i.e., 2 to 3 orders of magnitude greater than the Project Action Limit [PALs]), then the Partnering Team will consider the need to investigate the migration from groundwater to surface water during Phase II of the RI as concentrations at these levels may be indicative of free-product (i.e., a long-term continuing source of contamination).

10.4.4 Potential Receptors

Potential receptors include persons currently employed at the site or future site construction workers who could interact with contaminated media. The area is restricted, and there are no residences within 3,000 feet of the site. Trespassing at NAS Jacksonville is extremely unlikely because of fencing and because of strict security measures, and access to PSC 38 is also restricted to only Navy personnel with weapons clearance.

Human receptors may be exposed to different media following various pathways based on their specific activities. These media include surface and subsurface soil, groundwater, surface water, and sediment.

Ecological receptors include animal and plant species that could be affected by contaminants at the site. Typically, ecological receptors can be exposed only to surface media – surface soil, surface water, and the upper layers of wetland sediments. However, the site, and the 100 foot buffer zone around the site, does not present the type of habitat that would be exploited by ecological receptors as the site contains three buildings, several parking lots, is well maintained, and is heavily used. The 100 foot buffer zone is covered with grass, it is well maintained and, like the site, does not present the type of habitat that would

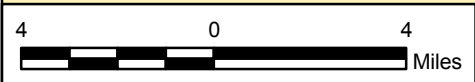
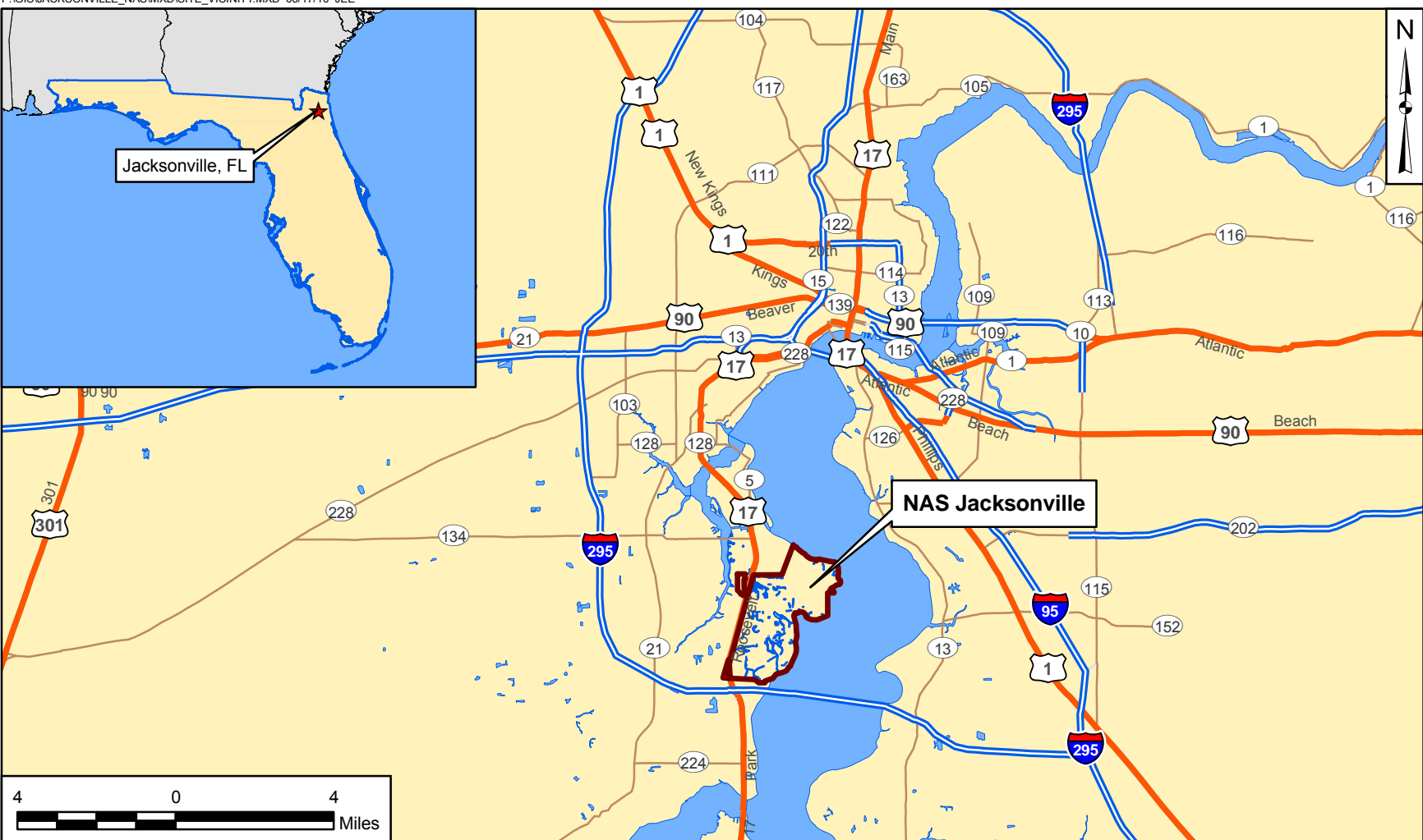
be exploited by ecological receptors. Therefore, ecological receptors are not expected to visit or inhabit the site or the grassed buffer zone around the site. Thus, the potential for exposure of ecological receptors to target analytes at PSC 38 is insignificant and the site presents no unacceptable risk to ecological receptors.

The Navy continues its efforts to reduce soil contamination and exposure to contaminated soil throughout NAS Jacksonville. In restricted areas such as PSC 38, the Navy has posted signs where soil has not been remediated, used institutional controls to limit future property use, and excavated several areas with contaminated soil. As long as industrial areas remain restricted, site usage does not change, and remedial activities continue at NAS Jacksonville, future health hazards from exposure to on-site surface soil within inaccessible areas is not anticipated.

10.4.5 Current and Potential Future Site Uses

PSC 38 is currently used for restricted, inaccessible industrial purposes and NAS Jacksonville is not proposed for Base Realignment and Closure; therefore, it is reasonable to assume that PSC 38 will continue to be used for industrial or non-residential purposes for the near future. Thus, the route of exposure is related to the types of activities that occur at an industrial site. This limits the route of exposure to dermal (direct contact with soil), incidental ingestion, and inhalation. The potential receptors are construction workers, maintenance or utility workers, and industrial workers. The existing concrete and asphalt pavement will be maintained with land use controls to restrict any direct exposure pathway, if it is determined that there is an unacceptable risk to human health. Similarly, the groundwater at NAS Jacksonville is not used as a drinking water source and is not expected to be in the future.

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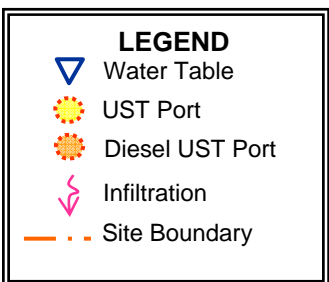
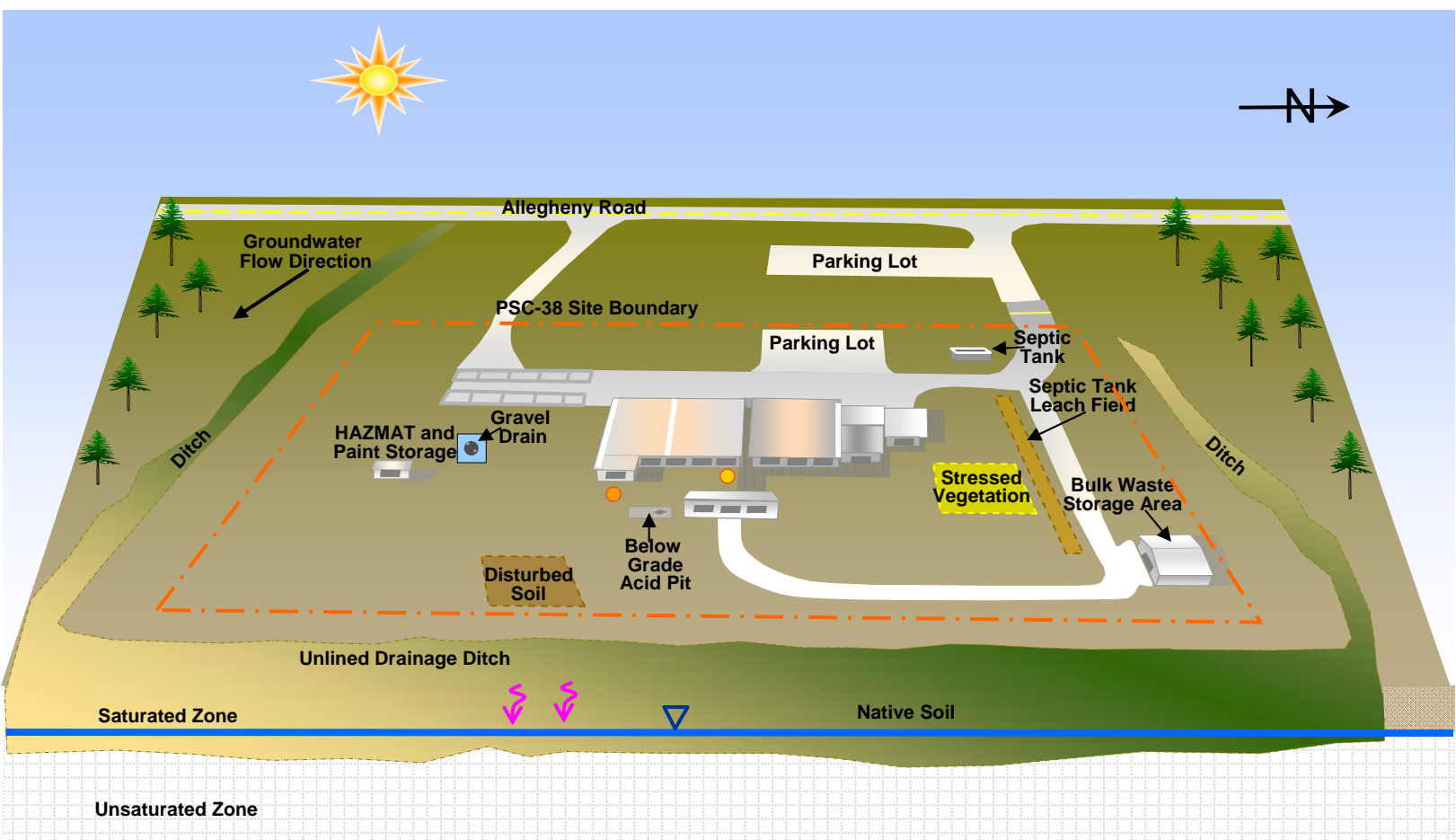
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T. WHEATON	06/14/10
CHECKED BY	DATE
A. PATE	08/17/10
COST/SCHEDULE AREA	
SCALE AS NOTED	




GENERAL LOCATION MAP
 NAS JACKSONVILLE
 JACKSONVILLE, FLORIDA

CONTRACT NUMBER CTO JM19	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO. FIGURE 10-1	REV 0





DRAWN BY C. PENNINGTON	DATE _____	CONTRACT NO. CTO JM19	
CHECKED BY B. PEEBLES	DATE _____	OWNER NO. _____	
REVISED BY P. CHURCHILL	DATE _____	APPROVED BY _____	DATE _____
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GENERIC SITE MODEL PSC 38 - TORPEDO REWORK FACILITY NAS JACKSONVILLE JACKSONVILLE, FLORIDA			

SAP Worksheet #11 – Data Quality Objectives/Systematic Planning Process Statements (UFP-QAPP Manual Section 2.6.1)

11.1 PROBLEM DEFINITION

Based on the site history and the CSM, it is likely that site-related contaminants are present in environmental media at PSC 38 at concentrations that exceed applicable risk-based human health screening values.

The nature and extent of contamination at PSC 38 has not been determined. It is also unknown if site-related contaminants persist at levels that could pose an unacceptable level of human health or environmental risk. Therefore, an RI must be conducted at PSC 38. The purpose of the PSC 38 Phase I RI is to develop data that enables the Partnering Team to determine (a) the nature and extent of contamination at PSC 38 and (b) the follow-up investigative activities that may be required. Upon receipt of the analytical results, the Partnering Team will evaluate the data from this Phase I RI to make decisions regarding the next steps.

11.2 INFORMATION INPUTS

Data is required for making decisions regarding the potential impact from environmental contaminants that may be present at PSC 38. The following physical and chemical data will be collected during the Phase I RI:

1. Data collected from previous investigations will not be used to quantify contamination that has already been identified in soil and groundwater since the data is over 10 years old, but will be used to guide the sampling location selection to areas that exceeded risk-based criteria in previous site investigations.
2. Chemical Data: Surface and subsurface soil and groundwater chemical data will be collected and analyzed to determine if target analytes are present in site media at concentrations greater than risk-based screening criteria, which are identified as the PALs. Surface soil samples will be collected using hand trowels and/or DPT cores. Subsurface soil samples will be collected using DPT cores. The list of target analytes and associated PALs for each matrix are identified in Worksheet #15. The analytical methods are presented in Worksheet #19.
3. PALs: To facilitate decision-making, the RI requires chemical data that can be compared to current state and federal soil and groundwater risk-based screening criteria and be used to support a screening level HHRA. A comprehensive list of the relevant environmental and medium-specific risk-based screening levels for the target analytes was determined and the

groundwater and soil data will be compared against the lowest applicable state or federal screening criteria for potential risk to receptors. The soil and groundwater PALs are the NAS Jacksonville basewide background values (see Appendix B), if the NAS Jacksonville background values are greater than the state (FDEP) or federal (USEPA) criteria, otherwise the most conservative or lesser value of the FDEP or USEPA criteria shall be used. To appropriately conduct comparisons of groundwater and soil data to the lowest applicable PALs, the selected laboratory must be able to achieve Detection Limits (DLs), Limits of Detection (LODs), and Limits of Quantitation (LOQs) that are low enough to measure constituent concentrations that are less than the PALs for as many target analytes as possible using conventional analytical methods. During project planning, some exceptions were noted for which the PALs will not be achievable with these methods. In those cases, Practical Quantitation Limits (PQLs) (same as LOQs) will become the default PAL in order for the Partnering Team to make decisions regarding this data. This approach is consistent with the FDEP's guidance on how to manage conditions when the cleanup target level (CTL) is less than the quantitation limit using conventional methods (FDEP, 2007). Any such data limitations will be documented in the RI report. The applicable FDEP and USEPA criteria are the following:

Soil

- NAS Jacksonville Basewide Background Concentrations (for metals).
- SCTLs for Florida Chapter 62-777, Florida Administrative Code (F.A.C.), Table II (Soils) - Residential direct exposure (SCTL-RES) and leachability based on groundwater criteria (SCTL-LCH).
- The laboratory PQLs should be used if it is less stringent than the CTL according to Chapter 62-780.680(2)(b)2.a.(III), F.A.C. The PQL is the lowest concentration that a laboratory can accurately report on a chemical.
- USEPA Regions 3, 6, and 9 (November 2010 or more recent) Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites - Residential soil values (USEPA-RES) and risk-based migration-to-groundwater Soil Screening Levels (USEPA-RISK).

Groundwater

- NAS Jacksonville Basewide Background Concentrations (for metals).
- FDEP GCTLs, Chapter 62-777, F.A.C. Table I (Groundwater).
- Florida Drinking Water Standards, Chapter 62-550.310, F.A.C.
- The laboratory PQL should be used if it is less stringent than the CTL, according to Chapter 62-780.680(1)(c), F.A.C. The PQL is the lowest concentration that a laboratory can accurately report on a chemical.

- USEPA MCLs.
- USEPA Regions 3, 6, and 9 (November 2010 or more recent date) RSLs for Chemical Contaminants at Superfund Sites - Tapwater (USEPA-TAP) values.

Analytical data reported by the laboratory use the following reporting conventions: All results below the DL will be considered non-detects (NDs), positive results reported at concentrations between the DL and LOQ will be reported with a "J" qualifier, and analytes not found (not detected) in a sample will be reported as the DL with a "U" qualifier.

11.3 STUDY BOUNDARIES

The study will be performed in a phased manner and will address the entire area of PSC 38. One of the objectives of the RI will be to define the boundaries of the contamination, which will require that both contaminated and non-contaminated media be sampled (i.e., the perimeter of the impacted area(s) must be established).

The following items address the horizontal, vertical, and temporal boundaries for Phase I of the study:

1. Horizontal: The horizontal boundary of the study is defined as the outer perimeter of the area where certain process operations took place, based on information from previous investigations. Horizontally, the entire area of PSC 38 plus the area of the drainage ditch that surrounds PSC 38 will be investigated. Lateral expansion of this horizontal study boundary may be necessary in Phase II, if any target analyte concentrations the Phase I samples collected along this boundary exceed the PALs. Groundwater and soils with target analyte concentrations in excess of their PALs are expected to be contained within the horizontal site boundaries as noted on Figure 10-1. This site boundary is based on the results of the prior site investigations (HLA, 1999).
2. Vertical: The vertical boundary of the study is defined as soil from the surface to the top of the water table, which is estimated at 6 to 10 feet bgs at the site. Vertically, both surface and subsurface soil will be assessed. The interval of interest for surface soil is 0 to 2 feet bgs for metals and 6 inches to 2 feet bgs for all other analytical groups. Subsurface soil samples will be collected at greater than 2 feet bgs. Surface and subsurface soil samples will be used for direct contact and migration-to-groundwater soil risk screening. The Phase I and Phase II interval of interest for surface soil is 0 to 6 inches for metals and 6 inches to 2 feet for all analytical groups, in accordance with FDEP guidance. The Phase I and Phase II interval of interest for subsurface soil is the interval between 2 to 4 feet bgs (or the top of the water table, whichever is shallower) for all analytical groups. Vertical expansion (deeper depths) may be necessary if target analyte concentrations in subsurface soil exceed the PALs. If subsurface soil contamination is observed,

samples may be collected into the vadose zone just above the water table, estimated to be 6 to 10 feet bgs.

3. Temporal: All target analyte concentrations are anticipated to be relatively unchanged (stable) over the course of time needed to conduct the environmental investigations and into the foreseeable future; therefore, no temporal constraints exist. PSC 38 RI Phase I field activities are scheduled for late summer 2011. Phase II activities, if deemed necessary, will be conducted in a timely manner.
4. The groundwater population of interest is groundwater that may have been contaminated by releases from PSC 38, including leaks from USTs and other releases from operations. This is generally groundwater located downgradient of the known releases and other operations areas. Upgradient groundwater is also of interest to provide a reference population and to help delineate contamination. Groundwater will be assessed at the site via temporary wells installed during the Phase I sampling round based on previously collected site data. Because there are no known permanent monitoring wells in the vicinity, depth to groundwater is not currently known, but it is estimated to be 6 to 10 feet bgs based on the proximity of surface water in the nearby drainage ditches and historical site data. If target analytes are identified in groundwater in excess of PALs, then the need for permanent monitoring wells for long-term monitoring will be evaluated by the Partnering Team. The vertical boundary for the groundwater population is 10 feet below the top of the water table, which is less than 20 feet bgs.

If any results from Phase I samples exceed a PAL and the Partnering Team deems it necessary, an addendum to this SAP will be submitted identifying the specific Phase II boundaries based on the Phase I data.

11.4 ANALYTIC APPROACH

The PSC 38 RI will be conducted in phases, in which the location(s) and extent of Phase II activities will be based on the Phase I data and the decisions that are made by the Partnering Team regarding the path forward based on the outcome of the Phase I results. A Phase I RI must be conducted to define areas of the site with elevated levels of contaminants. If concentrations of a target analyte exceed the risk-based screening values, then the target analyte will be identified as a Contaminant of Potential Concern (COPC). Phase II of the RI will follow to fully assess the nature and extent of contamination, and if necessary to conduct an HHRA. The Phase II Investigation plan will be presented in a SAP Addendum.

For the purpose of this SAP, the extent of contamination in groundwater and soil is determined by comparing the detected concentration of a target analyte against the PAL for that target analyte in the environmental media in which it was detected.

The decision statements for each phase of the study are as follows:

1. Determine whether chemical concentrations in site media (surface soil, subsurface soil, and groundwater) exceed the PALs within and around certain process areas that, based on historical site knowledge, previous analytical data, and the CSM, are the most likely areas to have been impacted by chemicals at PSC 38. If chemical concentrations in site media are less than the PALs, the Partnering Team will recommend NFA for the site.
2. If any analyte is detected in site media at a maximum concentration that exceeds a PAL and is greater than the site-specific background concentration (for metals), the Partnering Team will meet to discuss a path forward. The Partnering Team will review the data to determine the tasks that must be performed during Phase II to delineate the nature and extent of contamination and to determine if there is a need to conduct an HHRA. The Partnering Team will review the analytes that exceed the risk-based screening values based on specific factors that include the following:
 - The environmental media that is identified with an exceedance.
 - The particular compound(s) that is identified with an exceedance.
 - The magnitude of any exceedance, in frequency, distribution of samples, and concentrations as compared to the screening value.

The decision rules for Phase I of this investigation are as follows:

1. If target analyte concentrations in all surface soil, subsurface soil, and groundwater samples in the initial round of sampling are less than PALs, then recommend NFA; otherwise, advance to Rule 2. The target analytes include a specific list of VOCs, SVOCs including Low Level PAHs, PCBs, pesticides, and metals (see Worksheet #15).
2. For each target analyte, if the maximum measured concentration in any medium exceeds its PAL, then classify the chemical as a COPC for that medium and risk type; otherwise, exclude the chemical from further consideration in the risk screening.
3. If any concentrations of a target analyte in the Phase I round of biased (higher potential for impact) surface and subsurface soil samples exceed a PAL, then the Tetra Tech PM will

determine in concert with the Partnering Team the degree to which “step-out” samples (vertical or horizontal) are necessary in Phase II to define the vertical and/or horizontal extent of COPC contamination. The following rules govern data use for contaminant delineation:

4. If a constituent concentration in any subsurface soil sample on the exterior of the sampling pattern covering the area of interest exceeds PALs and site-specific background concentrations (for metals), then additional sampling outward will be necessary in Phase II to delineate the contamination. Otherwise, delineation is adequate, and no additional sampling is needed for delineation of the area of interest.

11.5 PERFORMANCE/ACCEPTANCE CRITERIA

Sample locations were selected based on the results from previous sampling events at PSC 38, so probability limits for false positive and false negative decision errors were not established for Phase I. Simple comparisons of measured concentrations to PALs and background concentrations (for metals) will be used. Sample locations were selected to determine the nature of surface and subsurface soil and groundwater contamination from areas most likely to be contaminated. This biased selection of sample locations does not support the use of quantitative statistics to estimate decision performance as specified in the USEPA QA/G-4, QA/G-5, and QA/G-5S DQO guidance documents (USEPA, 2006, 2002a, and 2002b, respectively). Instead, the Partnering Team will use the results of the Phase I activities to determine whether the amount and type of data collected are sufficient to support the attainment of the project quality objectives. This will involve an evaluation of contaminant concentrations and an evaluation of uncertainty for those contaminants that have a PAL less than the LOD to ensure that contaminants are likely to have been detected if present.

11.6 PLAN FOR OBTAINING DATA

Based on the information presented above, a detailed plan was developed to obtain the necessary data to answer the problem for the Phase I RI. The sampling design and rationale for all Phase I samples that will be collected are provided in Worksheet #17.

SAP Worksheet #12 – Measurement Performance Criteria Table - Field Quality Control Samples
(UFP-QAPP Manual Section 2.6.2)

Quality Control (QC) Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPCs)	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Equipment Rinsate Blank	All Analytical Groups	One per 20 field samples per matrix per sampling equipment ¹ .	Accuracy/Bias/Contamination	No analytes $\geq \frac{1}{2}$ LOQ, except common laboratory contaminants, which must be $< \text{LOQ}$.	S&A
Aqueous Trip Blank	VOCs	One per cooler containing VOC samples.	Accuracy/Bias/Contamination	No analytes $\geq \frac{1}{2}$ LOQ, except common laboratory contaminants, which must be $< \text{LOQ}$.	S&A
Field Duplicate	All Analytical Groups	One per 10 field samples collected.	Precision	Values $> 5\text{X LOQ}$: Relative Percent Difference (RPD) must be $\leq 30\%^{2,3}$ (aqueous); $\leq 50\%^{2,3}$ (solid).	S&A
Cooler Temperature Indicator	All Analytical Groups	One per cooler.	Representativeness	Temperature must be less than 6 degrees Celsius ($< 6^\circ \text{C}$).	S

Notes:

¹ Equipment rinsate blanks will be collected if non-dedicated equipment is used to collect samples. For disposable equipment, one sample per batch of disposable equipment will be collected

² If duplicate values for non-metals are $< 5\text{x LOQ}$, the absolute difference should be $< 2\text{x LOQ}$.

³ If duplicate values for metals are $< 5\text{x LOQ}$, the absolute difference should be $< 4\text{x LOQ}$.

SAP Worksheet #13 – Secondary Data Criteria and Limitations Table
 (UFP-QAPP Manual Section 2.7)

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
Aerial Photographs	Google Earth	Tetra Tech, Geographic Information Systems Department, January 2009	Data will be used to determine approximate sample areas and sample locations.	None.
Historical data on target analyte concentrations in soil and groundwater	Sampling Event Report, Potential Source of Contamination 38, Torpedo Rework Facility (HLA, 1999)	Originating Organization: HLA	Data may be used with data to be collected under this UFP-SAP to determine the appropriate response action for PSC 38.	Although the analytical data are not recent, given the non-mobile nature of target analytes, it is believed that the data, when used with data collected under this UFP-SAP, will help the Partnering Team make scientifically valid decisions on the appropriate response actions.

SAP Worksheet #14 – Summary of Project Tasks (UFP-QAPP Manual Section 2.8.1)

14.1 FIELD INVESTIGATION TASKS

The field activities include the following:

- Mobilization/Demobilization
- Health and Safety Training
- Utility Clearance/Dig Permits
- Monitoring Equipment Calibration
- Groundwater Sampling
- Surface and Subsurface Soil Sampling
- Investigation-Derived Waste (IDW) Management/Weekly Inspections
- Global Positioning System (GPS) Locating
- Field Decontamination Procedures
- Field Documentation Procedures

Additional project activities include the following tasks:

- Analytical Tasks
- Data Management
- Data Review
- Project Reports

14.2 MOBILIZATION/DEMobilIZATION

Each mobilization shall consist of the delivery of all equipment, materials, and supplies to the site; the complete assembly in satisfactory working order of all such equipment at the site; and the satisfactory storage at the site of all such materials and supplies. Tetra Tech will coordinate with the station to identify locations for the storage of equipment and supplies. Information on make/model of the GPS unit will be provided by Tetra Tech to the Explosive Safety Officer before the unit is placed in use. The GPS will not be in transmit mode.

The demobilization shall consist of the prompt and timely removal of all equipment, materials, and supplies from the site following completion of the work. Demobilization includes the cleanup and removal of waste generated during the conduction of the investigation.

14.3 HEALTH AND SAFETY TRAINING

Site-specific health and safety training will be provided to all Tetra Tech field staff and subcontractors as part of the site mobilization.

14.4 UTILITY CLEARANCE/DIG PERMITS

Prior to the commencement of any intrusive activities, Tetra Tech will coordinate utility clearance with the base and Sunshine State One Call. The base and utility companies subscribed to Sunshine State One Call will identify and mark-out utilities that may be present within the soil boring locations. The Tetra Tech FOL will also obtain a dig permit from the Public Works Department (PWD) at NAS Jacksonville. See Tetra Tech Standard Operating Procedure (SOP) HS-1.0 (in Appendix C) on conducting well installations for further information.

14.5 MONITORING EQUIPMENT CALIBRATION

These procedures are described in Worksheet #22.

14.6 GROUNDWATER SAMPLING

Groundwater sampling will be conducted at the PSC 38 via DPT techniques. Field methodologies for DPT groundwater sample collection are detailed below.

Groundwater samples will be collected using a DPT groundwater sampling system in conjunction with a peristaltic pump and sterile Teflon[®] and medical-grade silicon tubing. In general, the DPT groundwater sampling system consists of an enclosed 5-foot groundwater sampler attached to 2.125-inch outside diameter steel drive rods, which are hammer driven via DPT to the maximum desired sampling depth (at least 5 feet below the top of the water table or approximately 10 feet bgs).

When the desired sampling depth is reached, the outer sleeve of the groundwater sampler is retracted to expose a 5-foot mill-slotted (0.02-inch) well point screen to the formation. Teflon[®] tubing will then be lowered through the inner core of the DPT drive rod to the bottom of the borehole and attached to a peristaltic pump using silicon tubing. To minimize sediment loading, the tubing will be placed 2.5 feet from the bottom of each borehole in the center of the screen. A sample will be collected once the purge water becomes visibly clear. It is likely that the purge water will not become visibly clear due to fine sediments in this area. In this case, purging should be conducted for a minimum of 5 minutes before a sample is collected to reduce turbidity.

In general, groundwater samples will be collected from the 6 to 10 feet bgs interval. The actual sampling depth at each boring location is subject to change based on the lithology boring data. If any significant clay units (greater than 2 feet thick) are found, then a groundwater sample will be collected from the interval immediately above it. The boring will not be advanced through a significant clay unit.

Due to the nature of the sample collection, geochemical parameters and turbidity will not be measured during this sampling event. DPT groundwater samples will be collected and submitted to Empirical for analysis.

All sample locations will be marked with a wooden stake, brightly colored pin flag, or spray marking paint indicating the sample location. Coordinates will be determined by GPS at each individual sample location, which will allow for future repeatable investigations or guide in any remedial action. All removable sample location markers will be removed prior to the final demobilization.

All of the groundwater samples will be collected using the procedures specified in FDEP SOP FS 2200 for groundwater sampling (see Appendix C). Worksheets #17 and #18 specify the soil sampling locations and analyte groups for this investigation. Worksheet #19 specifies the analytical methods to be used.

14.7 SURFACE AND SUBSURFACE SOIL SAMPLING

Surface and subsurface soil sampling will be conducted at the PSC 38 via DPT techniques in accordance with Tetra Tech SOP SA-2.5. Field methodologies for DPT groundwater sample collection are detailed below.

Surface soils at PSC 38 are identified as the top 2 feet of soil (from 0 to 2 feet bgs). Subsurface soils are identified as the soil from 2 to 15 feet bgs, or the top of the water table, whichever is encountered first. Surface soil does not include surface pavement and the ground surface will begin at the bottom of a pavement or gravel layer. If an HHRA is deemed necessary, the Risk Assessment Report will discuss how these particular samples were addressed in the assessment with regard to potential exposure and actual risk.

All of the soil samples will be collected using the procedures specified in FDEP SOP FS 3000 (see Appendix C). Surface soil samples (from 0 to 2 feet bgs) will be collected with a hand auger, backhoe, or DPT, depending on site conditions. Sample jars will be filled using either a decontaminated stainless steel trowel or dedicated disposable plastic trowel. Subsurface soil samples will be collected at 2-foot intervals (from between 2 to 15 feet bgs or to the top of the water table, whichever is encountered first) using a DPT rig. The subsurface soil borings will be described by the Site Geologist in accordance with Tetra Tech SOP GH-1.5 (see Appendix C) and will be screened for evidence of contamination with a

photoionization detector (PID). A PID will be used to conduct jar head-space (or equivalent) screening to indicate whether a soil may be contaminated with VOCs. At each DPT boring, the subsurface soil interval that will be selected for analysis will be the 2-foot interval with the highest PID reading, or the 2-foot interval that is just above the top of the water table if no VOCs are detected by the PID. PID screening will be completed in accordance with Tetra Tech SOP SA-1.3 and the PID manufacturer's instructions. Any qualitative visual signs of potential contamination (such as odor or soil staining) will be noted on the soil boring log.

Soil samples will be analyzed for the list of VOCs, SVOCs/Low Level PAHs, pesticides, PCBs, and metals as presented in Worksheet #15, except for the surface soil samples collected from the 0 to 0.5 foot interval, which will only be analyzed for metals as required by FDEP SOPs. All surface and subsurface soil samples will be collected via FDEP SOPs and will be submitted to Empirical for analyses.

All sample locations will be marked with a wooden stake, brightly colored pin flag, or spray marking paint indicating the sample location. Coordinates will be determined by GPS at each individual sample location, which will allow for future repeatable investigations or guide in any remedial action. All removable sample location markers will be removed prior to the final demobilization.

All of the soil samples will be collected using the procedures specified in FDEP SOP FS 3000 for soil sampling (see Appendix C). Worksheets #17 and #18 specify the soil sampling locations and analyte groups for this investigation. Worksheet #19 specifies the analytical methods to be used.

14.8 INVESTIGATION-DERIVED WASTE MANAGEMENT

Types of IDW generated during this investigation that could be potentially contaminated include: groundwater and excess soil collected but not placed in the laboratory supplied sample containers, sampling equipment, decontamination wastewaters, and personnel protective equipment (PPE) and clothing. Groundwater displaced during this investigation and excess soil will be placed into labeled, sealable 55-gallon steel drums provided by the PWD. The drums will be inspected weekly until picked up and transported by the PWD to a secured area designated by the Navy. Proper disposal of these wastes will be performed by the Navy (or its designee) after the analytical results of the groundwater and soil samples are received from the laboratory and reviewed. PPE and clothing will be wiped clean and disposed of in trash containers as general refuse.

14.9 GLOBAL POSITION SYSTEM LOCATING

A GPS unit will be used to locate all sampling points in accordance with Tetra Tech SOP SOP-01 (see Appendix C). The GPS equipment will be checked on control monuments before and after each day's

use, and these checks will be documented in the field notebook. To ensure sub-meter accuracy, a minimum of six satellites are required to capture a position.

14.10 FIELD DECONTAMINATION PROCEDURE

Decontamination of major equipment and sampling equipment will be in general accordance with FDEP SOP FC 1000 and Tetra Tech SOP SA-7.1 (see Appendix C).

14.11 FIELD DOCUMENTATION PROCEDURES

Pre-preserved, certified-clean bottle ware will be supplied by Empirical. Matrix-specific sample log sheets will be maintained for each sample collected. In addition, sample collection information will be recorded in bound field notebooks or specific field forms. Samples will be packaged and shipped according to FDEP SOP FS 1000 (see Appendix C).

Field documentation will also be performed in accordance with Tetra Tech SOP SA-6.3 (see Appendix C). A summary of all field activities will be properly recorded in indelible ink in a bound logbook with consecutively numbered pages that cannot be removed. Logbooks will be assigned to field personnel and will be stored in a secured area when not in use.

At a minimum, the following information will be recorded in the site logbook:

- Name of the person to whom the logbook is assigned.
- Project name.
- Project start date.
- Names and responsibilities of on-site project personnel including subcontractor personnel.
- Arrival/departure of site visitors.
- Arrival/departure of equipment.
- Sampling activities and sample log sheet references.
- Description of subcontractor activities.
- Sample pick-up information including chain-of-custody numbers, air bill numbers, carrier, time, and date.
- Description of borehole or monitoring well installation activities and operations.
- Health and safety issues.
- Description of photographs including date, time, photographer, roll and picture number, location, and compass direction of photograph.

All entries will be written in indelible ink and no erasures will be made. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; the person making the correction will initial and date the change.

14.12 ANALYTICAL TASKS

Chemical analyses will be performed by Empirical. Empirical is a current Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) accredited and State of Florida Department of Health (FDOH) certified laboratory. A copy of the DoD ELAP accreditation and FDOH certification documents for Empirical are provided in Appendix D. Analyses will be performed in accordance with the analytical methods identified in Worksheet #19. Empirical is expected to meet the PALs to the extent identified in Worksheet #15. Empirical will perform chemical analysis following laboratory-specific SOPs (Worksheets #19 and #23) developed based on the analytical methods listed in Worksheets #19 and #30. Copies of the Laboratory SOPs are available for review.

All soil results will be reported by the laboratory on a dry-weight basis. Results of percent moisture will be reported in each analytical data package and electronic data files. This information will also be captured in the project database, which will eventually be uploaded to Naval Installation Restoration Information Solution. Percent moisture information will also be captured in the RI report.

The analytical data packages provided by Empirical will be in a contract laboratory program-like format and will be fully validatable and contain raw data, summary forms for all sample and laboratory method blank data, and summary forms containing all method specific quality control (QC) (results, recoveries, relative percent differences, relative standard deviations, and/or percent differences, etc.).

14.13 DATA MANAGEMENT

Data Handling and Management – After the field investigation is completed, the field sampling log sheets will be organized by date and media and filed in the project files. The field logbooks for this project will be used only for these sites and will also be categorized and maintained in the project files after the completion of the field program. Project personnel completing concurrent field sampling activities may maintain multiple field logbooks. When possible, logbooks will be segregated by sampling activity. The field logbooks will be titled based on date and activity. The data handling procedures to be followed by the laboratories will meet the requirements of the technical specification. The electronic data results will be automatically downloaded into the Tetra Tech database in accordance with proprietary Tetra Tech processes.

Data Tracking and Control – The Tetra Tech PM (or designee) is responsible for the overall tracking and control of data generated for the project.

- **Data Tracking:** Data is tracked from its generation to its archiving in the Tetra Tech project-specific files. The Tetra Tech Project Chemist (or designee) is responsible for tracking the samples collected and shipped to the subcontracted laboratory. Upon receipt of the data packages from the analytical laboratory, the Tetra Tech Project Chemist will oversee the data validation effort, which includes verifying that the data packages are complete and results for all samples have been delivered by the analytical laboratory.
- **Data Storage, Archiving, and Retrieval:** The data packages received from the subcontracted laboratory are tracked in the data validation logbook. After the data are validated, the data packages are entered into the Tetra Tech CLEAN file system and archived in secure files. The field records including field logbooks, sample logs, chain-of-custody records, and field calibration logs will be submitted by the Tetra Tech FOL to be entered into the CLEAN file system prior to archiving in secure project files. The project files are audited for accuracy and completeness. At the completion of the Navy contract, the records will be stored by Tetra Tech and eventually handed over to NAVFAC SE.
- **Data Security:** The Tetra Tech project files are restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The Tetra Tech Data Manager maintains the electronic data files. Access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

Assessment and Oversight – Refer to Worksheet #32 for assessment findings and corrective actions and Worksheet #33 for QA management reports.

14.14 DATA REVIEW

Data verification is described in Worksheet #34. Data validation is described in Worksheets #35 and #36. Usability assessment is described in Worksheet #37.

14.15 PROJECT REPORTS

The RI report will be prepared to document the results from the sampling event. The report will include appropriate sections concerning site investigation activities, physical characteristics, nature and extent of contamination, risk to receptors, conclusions and recommendations. Based on the results of the Phase I RI, the Partnering Team may deem it necessary to collect additional samples to determine the full nature

and extent of contamination and/or to perform an HHRA. The results of the Phase II sampling event will be incorporated into the RI report and will be issued in draft form to NAVFAC SE for initial review. NAVFAC SE comments will be addressed, and the draft final report will be issued to the USEPA and FDEP for regulatory review.

SAP Worksheet #15 – Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: VOCs

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
1,1,1-TRICHLOROETHANE	71-55-6	1.9	FDEP SCTL-LCH	0.005	0.0025	0.00125
1,1,2,2-TETRACHLOROETHANE	79-34-5	0.000026	USEPA-RISK	0.005	0.0025	0.00125
1,1,2-TRICHLOROETHANE	79-00-5	0.000078	USEPA-RISK	0.005	0.0025	0.00125
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	150	USEPA-RISK	0.005	0.0025	0.00125
1,1-DICHLOROETHANE	75-34-3	0.00069	USEPA-RISK	0.005	0.0025	0.00125
1,1-DICHLOROETHENE	75-35-4	0.06	FDEP SCTL-LCH	0.005	0.0025	0.00125
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	0.00000014	USEPA-RISK	0.005	0.0025	0.00125
1,2-DIBROMOETHANE	106-93-4	0.0000018	USEPA-RISK	0.005	0.0025	0.00125
1,2-DICHLOROBENZENE	95-50-1	0.36	USEPA-RISK	0.005	0.0025	0.00125
1,2-DICHLOROETHANE	107-06-2	0.000042	USEPA-RISK	0.005	0.0025	0.00125
1,2-DICHLOROPROPANE	78-87-5	0.00013	USEPA-RISK	0.005	0.0025	0.00125
1,3-DICHLOROBENZENE	541-73-1	7	FDEP SCTL-LCH	0.005	0.0025	0.00125
1,4-DICHLOROBENZENE	106-46-7	0.00041	USEPA-RISK	0.005	0.0025	0.00125
2-BUTANONE	78-93-3	1.5	USEPA-RISK	0.01	0.005	0.0025
2-HEXANONE	591-78-6	0.011	USEPA-RISK	0.005	0.0025	0.00125
4-METHYL-2-PENTANONE	108-10-1	0.45	USEPA-RISK	0.005	0.0025	0.00125
ACETONE	67-64-1	4.5	USEPA-RISK	0.02	0.01	0.005
BENZENE	71-43-2	0.00021	USEPA-RISK	0.005	0.0025	0.00125
BROMODICHLOROMETHANE	75-27-4	0.000032	USEPA-RISK	0.005	0.0025	0.00125
BROMOFORM	75-25-2	0.0023	USEPA-RISK	0.005	0.0025	0.00125

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
BROMOMETHANE	74-83-9	0.0022	USEPA-RISK	0.005	0.0025	0.00125
CARBON DISULFIDE	75-15-0	0.31	USEPA-RISK	0.005	0.0025	0.00125
CARBON TETRACHLORIDE	56-23-5	0.000077	USEPA-RISK	0.005	0.0025	0.00125
CHLOROBENZENE	108-90-7	0.062	USEPA-RISK	0.005	0.0025	0.00125
CHLORODIBROMOMETHANE	124-48-1	0.000039	USEPA-RISK	0.005	0.0025	0.00125
CHLOROETHANE	75-00-3	0.06	FDEP SCTL-LCH	0.005	0.0025	0.00125
CHLOROFORM	67-66-3	0.000053	USEPA-RISK	0.005	0.0025	0.00125
CHLOROMETHANE	74-87-3	0.01	FDEP SCTL-LCH	0.005	0.0025	0.00125
CIS-1,2-DICHLOROETHENE	156-59-2	0.11	USEPA-RISK	0.005	0.0025	0.00125
CIS-1,3-DICHLOROPROPENE	10061-01-5	0.00015	USEPA-RISK	0.005	0.0025	0.00125
CYCLOHEXANE	110-82-7	13	USEPA-RISK	0.005	0.0025	0.00125
DICHLORODIFLUOROMETHANE	75-71-8	0.61	USEPA-RISK	0.01	0.005	0.0025
ETHYLBENZENE	100-41-4	0.0017	USEPA-RISK	0.005	0.0025	0.00125
ISOPROPYLBENZENE	98-82-8	0.2	FDEP SCTL-LCH	0.005	0.0025	0.00125
METHYL ACETATE	79-20-9	7.5	USEPA-RISK	0.005	0.0025	0.00125
METHYL TERT-BUTYL ETHER	1634-04-4	0.0028	USEPA-RISK	0.005	0.0025	0.00125
METHYLENE CHLORIDE	75-09-2	0.0012	USEPA-RISK	0.005	0.0025	0.00125
METHYL CYCLOHEXANE	108-87-2	NA	None	0.005	0.0025	0.00125
STYRENE	100-42-5	1.8	USEPA-RISK	0.005	0.0025	0.00125
TETRACHLOROETHENE	127-18-4	0.000049	USEPA-RISK	0.005	0.0025	0.00125
TOLUENE	108-88-3	0.5	FDEP SCTL-LCH	0.005	0.0025	0.00125
O-XYLENE	95-47-6	0.2	FDEP SCTL-LCH	0.005	0.0025	0.00125
M+P-XYLENES	NA	0.2	FDEP SCTL-LCH	0.005	0.0025	0.00125
TRANS-1,2-DICHLOROETHENE	156-60-5	0.031	USEPA-RISK	0.005	0.0025	0.00125

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
TRANS-1,3-DICHLOROPROPENE	10061-02-6	1.7	USEPA-RES	0.005	0.0025	0.00125
TRICHLOROETHENE	79-01-6	0.00072	USEPA-RISK	0.005	0.0025	0.00125
TRICHLOROFLUOROMETHANE	75-69-4	0.83	USEPA-RISK	0.01	0.005	0.0025
VINYL CHLORIDE	75-01-4	0.0000056	USEPA-RISK	0.01	0.005	0.0025

The PAL references for soil; USEPA-RISK: USEPA Regions 3, 6, and 9 Risk-Based Migration to Groundwater Soil Screening Level; FDEP SCTL-RES: FDEP SCTL 62-777 Residential Soil-Direct Table II (FDEP); FDEP SCTL-LCH: FDEP SCTL 62-777 Leachability Based GW-Table II (FDEP); USEPA-RES: USEPA Regions 3, 6, and 9 Regional Screening Level for Soil, Residential.

Bolded rows indicate that the PAL is between the laboratory LOQ and LOD. The Partnering Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the LOD; therefore, the Partnering Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004).

Matrix: Soil

Analytical Group: SVOCs and Low Level PAHs

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
1-METHYLNAPHTHALENE (1)	90-12-0	0.012	USEPA-RISK	0.00667	0.00333	0.00167
1,1-BIPHENYL	92-52-4	0.2	FDEP SCTL-LCH	0.333	0.167	0.083
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	0.00012	USEPA-RISK	0.333	0.167	0.083
2,4,5-TRICHLOROPHENOL	95-95-4	0.07	FDEP SCTL-LCH	0.333	0.167	0.083
2,4,6-TRICHLOROPHENOL	88-06-2	0.023	USEPA-RISK	0.333	0.167	0.083
2,4-DICHLOROPHENOL	120-83-2	0.003	FDEP SCTL-LCH	0.333	0.167	0.083
2,4-DIMETHYLPHENOL	105-67-9	0.86	USEPA-RISK	1.33	0.667	0.333
2,4-DINITROPHENOL	51-28-5	0.06	FDEP SCTL-LCH	3.33	1.67	0.83
2,4-DINITROTOLUENE	121-14-2	0.00029	USEPA-RISK	0.333	0.167	0.083
2,6-DINITROTOLUENE	606-20-2	0.0004	FDEP SCTL-LCH	0.333	0.167	0.083
2-CHLORONAPHTHALENE	91-58-7	15	USEPA-RISK	0.333	0.167	0.083
2-CHLOROPHENOL	95-57-8	0.15	USEPA-RISK	0.333	0.167	0.083
2-METHYLNAPHTHALENE (1)	91-57-6	0.75	USEPA-RISK	0.00667	0.00333	0.00167
2-METHYLPHENOL	95-48-7	0.3	FDEP SCTL-LCH	0.333	0.167	0.083
2-NITROANILINE	88-74-4	0.1	FDEP SCTL-LCH	1.33	0.667	0.333
2-NITROPHENOL	88-75-5	NA	None	0.333	0.167	0.083
3,3'-DICHLOROBENZIDINE	91-94-1	0.00098	USEPA-RISK	0.333	0.167	0.083
3-NITROANILINE	99-09-2	0.01	FDEP SCTL-LCH	1.33	0.667	0.333
4,6-DINITRO-2-METHYLPHENOL	534-52-1	0.0062	USEPA-RISK	3.33	1.67	0.83
4-BROMOPHENYL PHENYL ETHER	101-55-3	NA	None	0.333	0.167	0.083
4-CHLORO-3-METHYLPHENOL	59-50-7	0.4	FDEP SCTL-LCH	0.333	0.167	0.083

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
4-CHLOROANILINE	106-47-8	0.00014	USEPA-RISK	0.333	0.167	0.083
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	NA	None	0.333	0.167	0.083
4-METHYLPHENOL	106-44-5	0.03	FDEP SCTL-LCH	0.333	0.167	0.083
4-NITROANILINE	100-01-6	0.0014	USEPA-RISK	1.33	0.667	0.333
4-NITROPHENOL	100-02-7	0.3	FDEP SCTL-LCH	1.33	0.667	0.333
ACENAPHTHENE (1)	83-32-9	2.1	FDEP SCTL-LCH	0.00667	0.00333	0.00167
ACENAPHTHYLENE (1)	208-96-8	22	USEPA-RISK	0.00667	0.00333	0.00167
ACETOPHENONE	98-86-2	1.1	USEPA-RISK	0.333	0.167	0.083
ANTHRACENE (1)	120-12-7	29	USEPA-RISK	0.00667	0.00333	0.00167
ATRAZINE	1912-24-9	0.00019	USEPA-RISK	0.333	0.167	0.083
BENZALDEHYDE	100-52-7	0.81	USEPA-RISK	0.333	0.167	0.083
BENZO(A)ANTHRACENE (1)	56-55-3	0.01	USEPA-RISK	0.00667	0.00333	0.00167
BENZO(A)PYRENE (1)	50-32-8	0.0035	USEPA-RISK	0.00667	0.00333	0.00167
BENZO(B)FLUORANTHENE (1)	205-99-2	0.035	USEPA-RISK	0.00667	0.00333	0.00167
BENZO(G,H,I)PERYLENE (1)	191-24-2	1.1	USEPA-RISK	0.00667	0.00333	0.00167
BENZO(K)FLUORANTHENE (1)	207-08-9	0.35	USEPA-RISK	0.00667	0.00333	0.00167
BIS(2-CHLOROETHOXY)METHANE	111-91-1	0.025	USEPA-RISK	0.333	0.167	0.083
BIS(2-CHLOROETHYL)ETHER	111-44-4	0.000031	USEPA-RISK	0.333	0.167	0.083
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	1.1	USEPA-RISK	0.333	0.167	0.083
BUTYL BENZYL PHTHALATE	85-68-7	0.51	USEPA-RISK	0.333	0.167	0.083
CAPROLACTAM	105-60-2	4.5	USEPA-RISK	0.333	0.167	0.083
CARBAZOLE	86-74-8	0.2	FDEP SCTL-LCH	0.333	0.167	0.083
CHRYSENE (1)	218-01-9	1.1	USEPA-RISK	0.00667	0.00333	0.00167
DIBENZO(A,H)ANTHRACENE (1)	53-70-3	0.011	USEPA-RISK	0.00667	0.00333	0.00167

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
DIBENZOFURAN	132-64-9	0.68	USEPA-RISK	0.333	0.167	0.083
DIETHYL PHTHALATE	84-66-2	12	USEPA-RISK	0.333	0.167	0.083
DIMETHYL PHTHALATE	131-11-3	380	FDEP SCTL-LCH	0.333	0.167	0.083
DI-N-BUTYL PHTHALATE	84-74-2	9.2	USEPA-RISK	0.333	0.167	0.083
DI-N-OCTYL PHTHALATE	117-84-0	1,700	FDEP SCTL-RES	0.333	0.167	0.083
FLUORANTHENE (1)	206-44-0	29	USEPA-RISK	0.00667	0.00333	0.00167
FLUORENE (1)	86-73-7	27	USEPA-RISK	0.00667	0.00333	0.00167
HEXACHLOROBENZENE	118-74-1	0.00053	USEPA-RISK	0.333	0.167	0.083
HEXACHLOROBUTADIENE	87-68-3	0.0017	USEPA-RISK	0.333	0.167	0.083
HEXACHLOROCYCLOPENTADIENE	77-47-4	0.68	USEPA-RISK	0.333	0.167	0.083
HEXACHLOROETHANE	67-72-1	0.0029	USEPA-RISK	0.333	0.167	0.083
INDENO(1,2,3-CD)PYRENE (1)	193-39-5	0.12	USEPA-RISK	0.00667	0.00333	0.00167
ISOPHORONE	78-59-1	0.023	USEPA-RISK	0.333	0.167	0.083
NAPHTHALENE	91-20-3	0.00047	USEPA-RISK	0.00667	0.00333	0.00167
NITROBENZENE	98-95-3	0.000079	USEPA-RISK	0.333	0.167	0.083
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	0.075	USEPA-RISK	0.333	0.167	0.083
N-NITROSODIPHENYLAMINE	86-30-6	0.0000072	USEPA-RISK	0.333	0.167	0.083
PENTACHLOROPHENOL	87-86-5	0.0057	USEPA-RISK	1.33	0.667	0.168

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
PHENANTHRENE (1)	85-01-8	29	USEPA-RISK	0.00667	0.00333	0.00167
PHENOL	108-95-2	0.05	FDEP SCTL-LCH	0.333	0.133	0.035
PYRENE (1)	129-00-0	1.1	USEPA-RISK	0.00667	0.00333	0.00167

(1) 8270C Low Level Full Scan SOP will be utilized for PAHs.

The PAL references for soil: USEPA-RISK: USEPA Regions 3, 6, and 9 Risk-Based Migration to Groundwater Soil Screening Level; FDEP SCTL-RES: FDEP SCTL 62-777 Residential Soil-Direct Table II (FDEP); FDEP SCTL-LCH: FDEP SCTL 62-777 Leachability Based GW-Table II (FDEP); USEPA-RES: USEPA Regions 3, 6, and 9 Regional Screening Level for Soil, Residential.

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Matrix: Soil
Analytical Group: Pesticides

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
4,4'-DDD	72-54-8	0.066	USEPA-RISK	0.0007	0.00035	0.00017
4,4'-DDE	72-55-9	0.047	USEPA-RISK	0.0007	0.00035	0.00017
4,4'-DDT	50-29-3	0.067	USEPA-RISK	0.0007	0.00035	0.00017
ALDRIN	309-00-2	0.00065	USEPA-RISK	0.0007	0.00035	0.00017
ALPHA-BHC	319-84-6	0.000062	USEPA-RISK	0.0007	0.00035	0.00017
ALPHA-CHLORDANE	5103-71-9	0.013	USEPA-RISK	0.0007	0.00035	0.00017
BETA-BHC	319-85-7	0.00022	USEPA-RISK	0.0007	0.00035	0.00017
DELTA-BHC	319-86-8	0.000062	USEPA-RISK	0.0007	0.00035	0.00017
DIELDRIN	60-57-1	0.00017	USEPA-RISK	0.0007	0.00035	0.00017
ENDOSULFAN I	959-98-8	3	USEPA-RISK	0.0007	0.00035	0.00017
ENDOSULFAN II	33213-65-9	3	USEPA-RISK	0.0007	0.00035	0.00017
ENDOSULFAN SULFATE	1031-07-8	3	USEPA-RISK	0.0007	0.00035	0.00017
ENDRIN	72-20-8	0.44	USEPA-RISK	0.0007	0.00035	0.00017
ENDRIN ALDEHYDE	7421-93-4	0.44	USEPA-RISK	0.0007	0.00035	0.00017
ENDRIN KETONE	53494-70-5	0.44	USEPA-RISK	0.0007	0.00035	0.00017
GAMMA-BHC (LINDANE)	58-89-9	0.00036	USEPA-RISK	0.0007	0.00035	0.00017
GAMMA-CHLORDANE	5103-74-2	0.013	USEPA-RISK	0.0007	0.00035	0.00017
HEPTACHLOR	76-44-8	0.0012	USEPA-RISK	0.0007	0.00035	0.00017

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
HEPTACHLOR EPOXIDE	1024-57-3	0.00015	USEPA-RISK	0.0007	0.00035	0.00017
METHOXYCHLOR	72-43-5	9.9	USEPA-RISK	0.0007	0.00035	0.00017
TOXAPHENE	8001-35-2	0.0094	USEPA-RISK	0.033	0.022	0.011

The PAL references for soil; USEPA-RISK: USEPA Regions 3, 6, and 9 Risk-Based Migration to Groundwater Soil Screening Level; FDEP SCTL-RES: FDEP SCTL 62-777 Residential Soil-Direct Table II (FDEP); FDEP SCTL-LCH: FDEP SCTL 62-777 Leachability Based GW-Table II (FDEP); USEPA-RES: USEPA Regions 3, 6, and 9 Regional Screening Level for Soil, Residential.

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BHC – Benzene Hexachloride
DDD – Dichlorodiphenyldichloroethane
DDE – Dichlorodiphenyldichloroethylene
DDT – Dichlorodiphenyltrichloroethane

Matrix: Soil
Analytical Group: PCBs

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
AROCLOR-1016	12674-11-2	0.092	USEPA-RISK	0.017	0.008	0.004
AROCLOR-1221	11104-28-2	0.00012	USEPA-RISK	0.017	0.008	0.004
AROCLOR-1232	11141-16-5	0.00012	USEPA-RISK	0.017	0.008	0.004
AROCLOR-1242	53469-21-9	0.0053	USEPA-RISK	0.017	0.008	0.004
AROCLOR-1248	12672-29-6	0.0052	USEPA-RISK	0.017	0.008	0.004
AROCLOR-1254	11097-69-1	0.0088	USEPA-RISK	0.017	0.008	0.004
AROCLOR-1260	11096-82-5	0.024	USEPA-RISK	0.017	0.008	0.004

The PAL references for soil; USEPA-RISK: USEPA Regions 3, 6, and 9 Risk-Based Migration to Groundwater Soil Screening Level; FDEP SCTL-RES: FDEP SCTL 62-777 Residential Soil-Direct Table II (FDEP); FDEP SCTL-LCH: FDEP SCTL 62-777 Leachability Based GW-Table II (FDEP); USEPA-RES: USEPA Regions 3, 6, and 9 Regional Screening Level for Soil, Residential.

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Matrix: Soil
Analytical Group: Metals

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
ALUMINUM	7429-90-5	55,000	USEPA-RISK	10	5	2.5
ANTIMONY	7440-36-0	0.66	USEPA-RISK	0.75	0.50	0.25
ARSENIC	7440-38-2	0.8 1.48 0.0013	Background (Surface) Background (Subsurface) USEPA-RISK	0.25	0.25	0.15
BARIUM	7440-39-3	120	FDEP SCTL-RES	2	0.50	0.25
BERYLLIUM	7440-41-7	58	USEPA-RISK	0.25	0.10	0.05
CADMIUM	7440-43-9	1.4	USEPA-RISK	0.25	0.10	0.05
CALCIUM	7440-70-2	NA	None	250	100	50
CHROMIUM	7440-47-3	38	FDEP SCTL-LCH	0.25	0.20	0.1
COBALT	7440-48-4	0.49	USEPA-RISK	0.63	0.50	0.25
COPPER	7440-50-8	51	USEPA-RISK	0.50	0.40	0.25
IRON	7439-89-6	852 5,818.2 640	Background (Surface) Background (Subsurface) USEPA-RISK	5	3	1.5
LEAD	7439-92-1	400	FDEP SCTL-RES	0.15	0.15	0.075
MAGNESIUM	7439-95-4	NA	None	250	150	50
MANGANESE	7439-96-5	57	USEPA-RISK	1.0	0.50	0.25
MERCURY	7439-97-6	0.03	USEPA-RISK	0.03	0.026	0.013
NICKEL	7440-02-0	48	USEPA-RISK	0.5	0.3	0.25
POTASSIUM	9/7/7440	NA	None	250	150	50
SELENIUM	7782-49-2	0.95	USEPA-RISK	0.3	0.25	0.15
SILVER	7440-22-4	1.6	USEPA-RISK	0.3	0.25	0.15

Analyte	CAS Number	PAL (mg/kg)	PAL Reference	Empirical		
				LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
SODIUM	7440-23-5	NA	None	250	150	50
THALLIUM	7440-28-0	2.8	FDEP SCTL-LCH	0.4	0.2	0.15
VANADIUM	7440-62-2	67	FDEP SCTL-RES	0.63	0.50	0.25
ZINC	7440-66-6	680	USEPA-RISK	1.0	0.5	0.25

The PAL references for soil; USEPA-RISK: USEPA Regions 3, 6, and 9 Risk-Based Migration to Groundwater Soil Screening Level; FDEP SCTL-RES: FDEP SCTL 62-777 Residential Soil-Direct Table II (FDEP); FDEP SCTL-LCH: FDEP SCTL 62-777 Leachability Based GW-Table II (FDEP); USEPA-RES: USEPA Regions 3, 6, and 9 Regional Screening Level for Soil, Residential; Background – NAS Jacksonville Basewide Background Levels.

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Matrix: Groundwater
Analytical Group: VOCs

Analyte	CAS Number	PAL (ug/L)	PAL Reference	Empirical		
				LOQ (ug/L)	LOD (ug/L)	DL (ug/L)
1,1,1-TRICHLOROETHANE	71-55-6	200	FDEP GCTL-GW	1	0.5	0.25
1,1,2,2-TETRACHLOROETHANE	79-34-5	0.067	USEPA-TAP	1	0.5	0.25
1,1,2-TRICHLOROETHANE	79-00-5	0.24	USEPA-TAP	1	0.5	0.25
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	59,000	USEPA-TAP	1	0.5	0.25
1,1-DICHLOROETHANE	75-34-3	2.4	USEPA-TAP	1	0.5	0.25
1,1-DICHLOROETHENE	75-35-4	7	FDEP GCTL-GW	1	0.5	0.25
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	0.00032	USEPA-TAP	2	1	0.5
1,2-DIBROMOETHANE	106-93-4	0.0065	USEPA-TAP	2	1	0.5
1,2-DICHLOROBENZENE	95-50-1	370	USEPA-TAP	1	0.5	0.25
1,2-DICHLOROETHANE	107-06-2	0.15	USEPA-TAP	1	0.5	0.25
1,2-DICHLOROPROPANE	78-87-5	0.39	USEPA-TAP	1	0.5	0.25
1,3-DICHLOROBENZENE	541-73-1	210	FDEP GCTL-GW	1	0.5	0.25
1,4-DICHLOROBENZENE	106-46-7	0.43	USEPA-TAP	1	0.5	0.25
2-BUTANONE	78-93-3	4,200	FDEP GCTL-GW	10	5	2.5
2-HEXANONE	591-78-6	47	USEPA-TAP	5	2.5	1.25
4-METHYL-2-PENTANONE	108-10-1	560	FDEP GCTL-GW	10	5	2.5
ACETONE	67-64-1	6,300	FDEP GCTL-GW	10	5	2.5
BENZENE	71-43-2	0.41	USEPA-TAP	1	0.5	0.25
BROMODICHLOROMETHANE	75-27-4	0.12	USEPA-TAP	1	0.5	0.25
BROMOFORM	75-25-2	4.4	FDEP GCTL-GW	2	1	0.5
BROMOMETHANE	74-83-9	8.7	USEPA-TAP	1	0.5	0.25
CARBON DISULFIDE	75-15-0	700	FDEP GCTL-GW	1	0.5	0.25

Analyte	CAS Number	PAL (ug/L)	PAL Reference	Empirical		
				LOQ (ug/L)	LOD (ug/L)	DL (ug/L)
CARBON TETRACHLORIDE	56-23-5	0.2	USEPA-TAP	1	0.5	0.25
CHLOROBENZENE	108-90-7	91	USEPA-TAP	1	0.5	0.25
CHLORODIBROMOMETHANE	124-48-1	0.15	USEPA-TAP	1	0.5	0.25
CHLOROETHANE	75-00-3	12	FDEP GCTL-GW	1	0.5	0.25
CHLOROFORM	67-66-3	0.19	USEPA-TAP	1	0.5	0.25
CHLOROMETHANE	74-87-3	2.7	FDEP GCTL-GW	1	0.5	0.25
CIS-1,2-DICHLOROETHENE	156-59-2	70	FDEP GCTL-GW	1	0.5	0.25
CIS-1,3-DICHLOROPROPENE	10061-01-5	0.43	USEPA-TAP	1	0.5	0.25
CYCLOHEXANE	110-82-7	13,000	USEPA-TAP	1	0.5	0.25
DICHLORODIFLUOROMETHANE	75-71-8	390	USEPA-TAP	1	0.5	0.25
ETHYLBENZENE	100-41-4	1.5	USEPA-TAP	1	0.5	0.25
ISOPROPYLBENZENE	98-82-8	0.8	FDEP GCTL-GW	1	0.5	0.25
METHYL ACETATE	79-20-9	3,000	FDEP GCTL-GW	2	1	0.5
METHYL TERT-BUTYL ETHER	1634-04-4	12	USEPA-TAP	1	0.5	0.25
METHYLENE CHLORIDE	75-09-2	4.8	USEPA-TAP	1	0.5	0.25
METHYL CYCLOHEXANE	108-87-2	NA	None	1	0.5	0.25
STYRENE	100-42-5	100	FDEP GCTL-GW	1	0.5	0.25
TETRACHLOROETHENE	127-18-4	0.11	USEPA-TAP	1	0.5	0.25
TOLUENE	108-88-3	40	FDEP GCTL-GW	1	0.5	0.25
O-XYLENE	95-47-6	20	FDEP GCTL-GW	1	0.5	0.25
M+P-XYLENES	NA	20	FDEP GCTL-GW	1	0.5	0.25
TRANS-1,2-DICHLOROETHENE	156-60-5	100	FDEP GCTL-GW	1	0.5	0.25
TRANS-1,3-DICHLOROPROPENE	10061-02-6	NA	None	1	0.5	0.25
TRICHLOROETHENE	79-01-6	2	USEPA-TAP	1	0.5	0.25

Analyte	CAS Number	PAL (ug/L)	PAL Reference	Empirical		
				LOQ (ug/L)	LOD (ug/L)	DL (ug/L)
TRICHLOROFLUOROMETHANE	75-69-4	1,300	USEPA-TAP	1	0.5	0.25
VINYL CHLORIDE	75-01-4	0.016	USEPA-TAP	1	0.5	0.25

The PAL references for groundwater are; USEPA-TAP: USEPA Regions 3, 6, and 9 Regional Screening Level for Tapwater; FDEP GCTL-GW: 62-777 GW-Table I (FDEP).

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Matrix: Groundwater
Analytical Group: SVOCs and Low Level PAHs

Analyte	CAS Number	PAL (µg/L)	PAL Reference	Empirical		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
1-METHYLNAPHTHALENE (1)	90-12-0	2.3	FDEP GCTL-GW	0.20	0.10	0.050
1,1-BIPHENYL	92-52-4	0.5	FDEP GCTL-GW	5	2.5	1.25
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	0.32	USEPA-TAP	5	2.5	1
2,4,5-TRICHLOROPHENOL	95-95-4	1	FDEP GCTL-GW	5	2.5	1.25
2,4,6-TRICHLOROPHENOL	88-06-2	3.2	FDEP GCTL-GW	5	2.5	1.25
2,4-DICHLOROPHENOL	120-83-2	0.3	FDEP GCTL-GW	5	2.5	1.25
2,4-DIMETHYLPHENOL	105-67-9	140	FDEP GCTL-GW	20	10	5
2,4-DINITROPHENOL	51-28-5	14	FDEP GCTL-GW	5	2.5	1.25
2,4-DINITROTOLUENE	121-14-2	0.05	FDEP GCTL-GW	5	2.5	1.25
2,6-DINITROTOLUENE	606-20-2	0.05	FDEP GCTL-GW	5	2.5	1.25
2-CHLORONAPHTHALENE	91-58-7	560	FDEP GCTL-GW	5	2.5	1.25
2-CHLOROPHENOL	95-57-8	35	FDEP GCTL-GW	5	2.5	1.25
2-METHYLNAPHTHALENE (1)	91-57-6	28	FDEP GCTL-GW	0.20	0.10	0.050
2-METHYLPHENOL	95-48-7	35	FDEP GCTL-GW	5	2.5	1
2-NITROANILINE	88-74-4	21	FDEP GCTL-GW	20	10	5
2-NITROPHENOL	88-75-5	NA	None	5	2.5	1.25
3,3'-DICHLOROBENZIDINE	91-94-1	0.08	FDEP GCTL-GW	5	2.5	1.25
3-NITROANILINE	99-09-2	1.7	FDEP GCTL-GW	20	10	5
4,6-DINITRO-2-METHYLPHENOL	534-52-1	3.7	USEPA-TAP	20	10	5
4-BROMOPHENYL PHENYL ETHER	101-55-3	NA	None	5	2.5	1.25
4-CHLORO-3-METHYLPHENOL	59-50-7	63	FDEP GCTL-GW	5	2.5	1.25
4-CHLOROANILINE	106-47-8	0.34	USEPA-TAP	5	2.5	1.25

Analyte	CAS Number	PAL (µg/L)	PAL Reference	Empirical		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	NA	None	5	2.5	1.25
4-METHYLPHENOL	106-44-5	3.5	FDEP GCTL-GW	5	2.5	1.25
4-NITROANILINE	100-01-6	1.7	FDEP GCTL-GW	20	10	5
4-NITROPHENOL	100-02-7	56	FDEP GCTL-GW	20	10	5
ACENAPHTHENE (1)	83-32-9	20	FDEP GCTL-GW	0.20	0.10	0.050
ACENAPHTHYLENE (1)	208-96-8	210	FDEP GCTL-GW	0.20	0.10	0.050
ACETOPHENONE	98-86-2	700	FDEP GCTL-GW	5	2.5	1.25
ANTHRACENE (1)	120-12-7	2,100	FDEP GCTL-GW	0.20	0.10	0.050
ATRAZINE	1912-24-9	0.29	USEPA-TAP	5	2.5	1.25
BENZALDEHYDE	100-52-7	700	FDEP GCTL-GW	5	2.5	1.25
BENZO(A)ANTHRACENE (1)	56-55-3	0.029	USEPA-TAP	0.20	0.10	0.050
BENZO(A)PYRENE (1)	50-32-8	0.0029	USEPA-TAP	0.20	0.10	0.050
BENZO(B)FLUORANTHENE (1)	205-99-2	0.029	USEPA-TAP	0.20	0.10	0.050
BENZO(G,H,I)PERYLENE (1)	191-24-2	210	FDEP GCTL-GW	0.20	0.10	0.050
BENZO(K)FLUORANTHENE (1)	207-08-9	0.29	USEPA-TAP	0.20	0.10	0.050
BIS(2-CHLOROETHOXY)METHANE	111-91-1	110	USEPA-TAP	5	2.5	1.25
BIS(2-CHLOROETHYL)ETHER	111-44-4	0.012	USEPA-TAP	5	2.5	1.25
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	4.8	USEPA-TAP	5	2.5	1.25
BUTYL BENZYL PHTHALATE	85-68-7	35	USEPA-TAP	5	2.5	1.25
CAPROLACTAM	105-60-2	18,000	USEPA-TAP	5	2.5	1.25
CARBAZOLE	86-74-8	1.8	FDEP GCTL-GW	5	2.5	1.25
CHRYSENE (1)	218-01-9	2.9	USEPA-TAP	0.20	0.10	0.050
DIBENZO(A,H)ANTHRACENE (1)	53-70-3	0.0029	USEPA-TAP	0.20	0.10	0.050
DIBENZOFURAN	132-64-9	28	FDEP GCTL-GW	5	2.5	1.25

Analyte	CAS Number	PAL (µg/L)	PAL Reference	Empirical		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
DIETHYL PHTHALATE	84-66-2	5,600	FDEP GCTL-GW	5	2.5	1.25
DIMETHYL PHTHALATE	131-11-3	70,000	FDEP GCTL-GW	5	2.5	1.25
DI-N-BUTYL PHTHALATE	84-74-2	700	FDEP GCTL-GW	5	2.5	1.25
DI-N-OCTYL PHTHALATE	117-84-0	140	FDEP GCTL-GW	5	2.5	1.25
FLUORANTHENE (1)	206-44-0	280	FDEP GCTL-GW	0.20	0.10	0.050
FLUORENE (1)	86-73-7	280	FDEP GCTL-GW	0.20	0.10	0.050
HEXACHLOROBENZENE	118-74-1	0.042	USEPA-TAP	5	2.5	1.25
HEXACHLOROBUTADIENE	87-68-3	0.4	FDEP GCTL-GW	5	2.5	1.25
HEXACHLOROCYCLOPENTADIENE	77-47-4	50	FDEP GCTL-GW	5	2.5	1.25
HEXACHLOROETHANE	67-72-1	2.5	FDEP GCTL-GW	5	2.5	1.25
INDENO(1,2,3-CD)PYRENE (1)	193-39-5	0.029	USEPA-TAP	0.20	0.10	0.050
ISOPHORONE	78-59-1	37	FDEP GCTL-GW	5	2.5	1.25
NAPHTHALENE (1)	91-20-3	0.14	USEPA-TAP	0.20	0.10	0.050
NITROBENZENE	98-95-3	0.12	USEPA-TAP	5	2.5	1.25
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	0.005	FDEP GCTL-GW	5	2.5	1.25
N-NITROSODIPHENYLAMINE	86-30-6	7.1	FDEP GCTL-GW	5	2.5	1.25
PENTACHLOROPHENOL	87-86-5	0.56	USEPA-TAP	20	10	5

Analyte	CAS Number	PAL (µg/L)	PAL Reference	Empirical		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
PHENANTHRENE (1)	85-01-8	210	FDEP GCTL-GW	0.20	0.10	0.050
PHENOL	108-95-2	10	FDEP GCTL-GW	5	2.5	1.25
PYRENE (1)	129-00-0	210	FDEP GCTL-GW	0.20	0.10	0.050

(1) 8270C Low Level Full Scan SOP will be utilized for PAHs.

The PAL references for groundwater are; USEPA-TAP: USEPA Regions 3, 6, and 9 Regional Screening Level for Tapwater; FDEP GCTL-GW: 62-777 GW-Table I (FDEP).

Bolded rows indicate that the PAL is between the laboratory LOQ and LOD. The Partnering Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the LOD; therefore, the Partnering Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004).

Matrix: Groundwater
Analytical Group: Pesticides

Analyte	CAS Number	PAL (µg/L)	PAL Reference	Empirical		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
4,4'-DDD	72-54-8	0.1	FDEP GCTL-GW	0.02	0.01	0.005
4,4'-DDE	72-55-9	0.1	FDEP GCTL-GW	0.02	0.01	0.005
4,4'-DDT	50-29-3	0.1	FDEP GCTL-GW	0.02	0.01	0.005
ALDRIN	309-00-2	0.002	FDEP GCTL-GW	0.02	0.01	0.005
ALPHA-BHC	319-84-6	0.006	FDEP GCTL-GW	0.02	0.01	0.005
ALPHA-CHLORDANE	5103-71-9	0.19	USEPA-TAP	0.02	0.01	0.005
BETA-BHC	319-85-7	0.02	FDEP GCTL-GW	0.02	0.01	0.005
DELTA-BHC	319-86-8	0.011	USEPA-TAP	0.02	0.01	0.005
DIELDRIN	60-57-1	0.002	FDEP GCTL-GW	0.02	0.01	0.005
ENDOSULFAN I	959-98-8	220	USEPA-TAP	0.02	0.01	0.005
ENDOSULFAN II	33213-65-9	220	USEPA-TAP	0.02	0.01	0.005
ENDOSULFAN SULFATE	1031-07-8	220	USEPA-TAP	0.02	0.01	0.005
ENDRIN	72-20-8	2	FDEP GCTL-GW	0.02	0.01	0.005
ENDRIN ALDEHYDE	7421-93-4	11	USEPA-TAP	0.02	0.01	0.005
ENDRIN KETONE	53494-70-5	11	USEPA-TAP	0.02	0.01	0.005
GAMMA-BHC (LINDANE)	58-89-9	0.061	USEPA-TAP	0.02	0.01	0.005
GAMMA-CHLORDANE	5103-74-2	0.19	USEPA-TAP	0.02	0.01	0.005
HEPTACHLOR	76-44-8	0.015	USEPA-TAP	0.02	0.01	0.005
HEPTACHLOR EPOXIDE	1024-57-3	0.0074	USEPA-TAP	0.02	0.01	0.005

Analyte	CAS Number	PAL (µg/L)	PAL Reference	Empirical		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
METHOXYCHLOR	72-43-5	40	FDEP GCTL-GW	0.02	0.01	0.005
TOXAPHENE	8001-35-2	0.061	USEPA-TAP	1	0.67	0.33

The PAL references for groundwater are: USEPA-TAP: USEPA Regions 3, 6, and 9 Regional Screening Level for Tapwater; FDEP GCTL-GW: 62-777 GW-Table I (FDEP).

Bolded rows indicate that the PAL is between the laboratory LOQ and LOD. The Partnering Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the LOD; therefore, the Partnering Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004).

Matrix: Groundwater
Analytical Group: PCBs

Analyte	CAS Number	PAL (ug/L)	PAL Reference	Empirical		
				LOQ (ug/L)	LOD (ug/L)	DL (ug/L)
AROCLOR-1016	12674-11-2	0.96	USEPA-TAP	0.5	0.25	0.125
AROCLOR-1221	11104-28-2	0.0068	USEPA-TAP	0.5	0.25	0.125
AROCLOR-1232	11141-16-5	0.0068	USEPA-TAP	0.5	0.25	0.125
AROCLOR-1242	53469-21-9	0.034	USEPA-TAP	0.5	0.25	0.125
AROCLOR-1248	12672-29-6	0.034	USEPA-TAP	0.5	0.25	0.125
AROCLOR-1254	11097-69-1	0.034	USEPA-TAP	0.5	0.25	0.125
AROCLOR-1260	11096-82-5	0.034	USEPA-TAP	0.5	0.25	0.125

The PAL references for groundwater are; USEPA-TAP: USEPA Regions 3, 6, and 9 Regional Screening Level for Tapwater; FDEP GCTL-GW: 62-777 GW-Table I (FDEP).

Bolded rows indicate that the PAL is between the laboratory LOQ and LOD. The Partnering Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the LOD; therefore, the Partnering Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004).

Matrix: Groundwater
Analytical Group: Metals

Analyte	CAS Number	PAL (µg/L)	PAL Reference	Empirical		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
ALUMINUM	7429-90-5	147,318 200	Background FDEP GCTL-GW	200	100	50
ANTIMONY (1)	7440-36-0	43 6	Background FDEP GCTL-GW	4	2	1.25
ARSENIC (1)	7440-38-2	13.2 0.045	Background USEPA-TAP	1.5	1.5	0.75
BARIUM	7440-39-3	2,000	FDEP GCTL-GW	40	10	5
BERYLLIUM	7440-41-7	8.2 4	Background FDEP GCTL-GW	4	2	1
CADMIUM	7440-43-9	8.2 5	Background FDEP GCTL-GW	5	2	1
CALCIUM	7440-70-2	NA	None	5,000	2,000	1,000
CHROMIUM	7440-47-3	208 100	Background FDEP GCTL-GW	10	4	2
COBALT	7440-48-4	22.6 11	Background USEPA-TAP	11	10	5
COPPER	7440-50-8	1,000	FDEP GCTL-GW	10	8	4
IRON	7439-89-6	68,292 300	Background FDEP GCTL-GW	100	60	30
LEAD	7439-92-1	45.8 15	Background FDEP GCTL-GW	3	3	1.5
MAGNESIUM	7439-95-4	NA	None	5,000	2,000	1,000

Analyte	CAS Number	PAL (µg/L)	PAL Reference	Empirical		
				LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
MANGANESE	7439-96-5	204 50	Background FDEP GCTL-GW	15	10	5
MERCURY	7439-97-6	0.98 0.57	Background USEPA-TAP	0.2	0.16	0.08
NICKEL	7440-02-0	100	FDEP GCTL-GW	10	6	3
POTASSIUM	9/7/7440	NA	None	5,000	2,000	1,000
SELENIUM	7782-49-2	50	FDEP GCTL-GW	6	5	3
SILVER	7440-22-4	100	FDEP GCTL-GW	10	2	1
SODIUM	7440-23-5	160,000	FDEP GCTL-GW	5,000	2,000	1,000
THALLIUM (1)	7440-28-0	2	FDEP GCTL-GW	2	1	0.75
VANADIUM	7440-62-2	294 49	Background FDEP GCTL-GW	12.5	10	5
ZINC	7440-66-6	5,000	FDEP GCTL-GW	20	10	5

(1) Empirical will concentrate 4X per USEPA 200.7 to obtain lower detection limits for these analytes.

The PAL references for groundwater are: USEPA-TAP: USEPA Regions 3, 6, and 9 Regional Screening Level for Tapwater; FDEP GCTL-GW: 62-777 GW-Table I (FDEP); Background – NAS Jacksonville Basewide Background Levels.

Bolded rows indicate that the PAL is between the laboratory LOQ and LOD. The Partnering Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Shaded and Bolded rows indicate the PAL is less than the LOD; therefore, the Partnering Team has agreed to replace the PALs with the laboratory LOQs for decision making purposes, as suggested in "Guidance for the Selection of Analytical Methods for the Evaluation of Practical Quantitation Limits" (FDEP, 2004).

SAP Worksheet #16 – Project Schedule / Timeline Table
(UFP-QAPP Manual Section 2.8.2)

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Field Team Phase I Mobilization	Tetra Tech	1/23/2012	1/24/2012	NA	NA
Groundwater and Soil Sampling	Tetra Tech	1/24/2012	2/13/2012		
Phase I Demobilization	Tetra Tech	2/13/2012	2/24/2012	NA	NA
Partnering Team Meeting	Partnering Team	5/15/2012	5/16/2012	NA	NA
Field Team Phase II Mobilization	Tetra Tech	5/28/2012	5/29/2012	NA	NA
Phase II Groundwater and Soil Sampling	Tetra Tech	5/29/2012	6/8/2012	NA	NA
Phase II Demobilization	Tetra Tech	6/8/2012	6/9/2012	NA	NA
Draft Remedial Investigation/Feasibility Study Report Submittal	Tetra Tech	6/29/2012	10/30/2012	Report Phase I RI Draft Submittal	10/30/2012

SAP Worksheet #17 – Sampling Design and Rationale **(UFP-QAPP Manual Section 3.1.1)**

The proposed groundwater and soil sampling locations for PSC 38 were selected based on the CSM, the current understanding of site-specific conditions, and the need to collect data that will address the project objectives. The sampling program was designed based on the need to collect additional data in areas that are most likely to be contaminated. Furthermore, chemical concentrations in soil and groundwater were identified during previous investigations of several potential PSC 38 source areas (HLA, 1999); however, neither the nature nor the extent of the contamination was fully characterized.

At PSC 38, new data will be used to determine the nature and extent of contamination in surface soil, subsurface soil, and groundwater and to select COPCs that will be evaluated with additional data collected during Phase II, if required. The sampling location and rationale for each sample is provided in Worksheet #18.

17.1 GROUNDWATER SAMPLING

Ten groundwater sample locations are associated with the site for the Phase I RI. Groundwater samples will be collected from 10 borings installed by DPT (see Figure 17-1 and Worksheet #18). One groundwater sample per location will be collected. Actual DPT sampling locations may need to be relocated based on physical obstructions or utilities. Seven of the 10 locations will be collected from the same boring from which the surface and subsurface soil samples will be collected once the DPT boring has been pushed sufficiently into the water table to collect a groundwater sample using a 5-foot screen as described in Worksheet #14. The other three locations will be located approximately 10 feet from the three drainage ditch soil sample locations, placed closer to the fenced in area of PSC 38. For example, the groundwater sample that corresponds with the soil sample taken from the center of the drainage ditch to the north of PSC 38 will be located approximately 10 feet south of the north drainage ditch.

The target analytes associated with the groundwater samples are presented in Worksheet #15. The Analytical Method/SOPs are identified in Worksheet #23. The number of QC samples is presented in Worksheet #20.

17.2 SURFACE AND SUBSURFACE SOIL SAMPLING

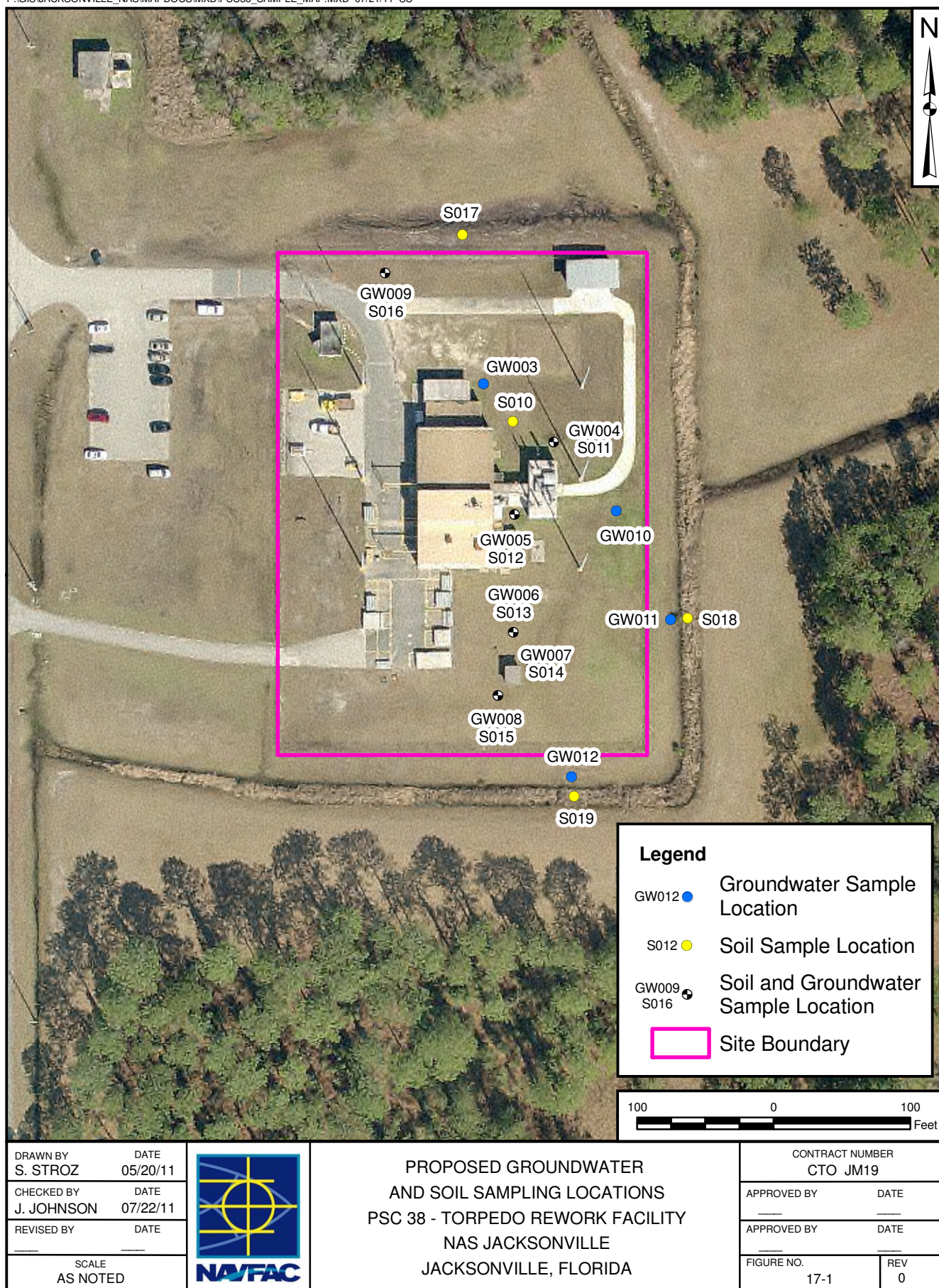
Ten soil sample locations are associated with the site for the Phase I RI. Soil samples will be collected from the 10 borings installed by DPT (see Figure 17-1 and Worksheet #18). Three soil horizons per location will be collected as described in Worksheet #14. Actual DPT sampling locations may need to be relocated based on physical obstructions or utilities. The number of sample locations and the sampling intervals are summarized below.

Sample Type	Number of Sample Locations	Sampling Intervals			Total Field Samples	Total Field QC Samples
		0 to 0.5 feet	0.5 to 2 feet	2 to 4 feet ¹		
Soil (Metals Only)	10	x	x	x	30	6
Soil (All Other Analytical Groups)	10		x	x	20	4

¹ The sampling interval for subsurface soil samples that will be submitted for analysis will be the DPT boring 2-foot interval (from between 2 feet bgs to 15 feet bgs or the top of the water table, whichever is encountered first) that exhibits the highest PID reading, or the 2-foot interval from just above the top of the water table, if volatile organics are not detected by PID.

The sampling intervals for each sample location will be as follows: 0 to 6 inches bgs (for metals only), 6 inches to 2 feet bgs, and the 2-foot interval as described in the footnote to the table presented above. This approach yields 30 soil samples for metals and 20 soil samples for all other analytical groups.

The target analytes associated with the soil samples are presented in Worksheet #15. The Analytical Method/SOPs are identified in Worksheet #23. The number of QC samples is presented in Worksheet #20.



SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

The sample locations and methods/SOP requirements are presented in Sections 18.1 and 18.2.

SAP Worksheet #18.1 – Groundwater Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Identification (ID) Number ¹	Matrix	Depth (feet bgs) ²	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Sampling Location Rationale
38GW003	38GW00301	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1 + duplicate	FS 1000, FS 2000, and FS 2200	Approximately 30 feet north of 38S006 (Removed Gravel Sump)
38GW004	38GW00401	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	Approximately 30 feet east of 38S006 (Removed Gravel Sump)
38GW005	38GW00501	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	Approximately 30 feet south of 38S006 (Removed Gravel Sump)
38GW006	38GW00601	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	Approximately 30 feet northeast of 38S009 (Gravel Drain)
38GW007	38GW00701	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	Approximately 30 feet east of 38S009 (Gravel Drain)
38GW008	38GW00801	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	Approximately 30 feet south of 38S009 (Gravel Drain)

Sampling Location	Identification (ID) Number ¹	Matrix	Depth (feet bgs) ²	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Sampling Location Rationale
38GW009	38GW00901	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	Anticipated Background/ Upgradient Location
38GW010	38GW01001	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	South of Drainage Ditch North of PSC 38
38GW011	38GW01101	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	West of Drainage Ditch East of PSC 38
38GW012	38GW01201	Water	6-10	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1	FS 1000, FS 2000, and FS 2200	North of Drainage Ditch South of PSC 38

¹The ID number consists of, in order, 38 for PSC 38, GW for groundwater and then the number of the sample, starting at 003 for groundwater (groundwater samples 001-002 were collected previously). The duplicate samples will be identified by adding a D at the end of the ID number; therefore, it would be 38GW00301D. Further definitions for sample nomenclature can be found in Tetra Tech SOP CT-04 included in Appendix C.

² In general, groundwater samples will be collected from the top 5 feet of the water table, estimated to begin at the 6 to 10 feet bgs interval. The actual sampling depth at each boring location is subject to change based on the lithology boring data. If any significant clay units (greater than 2 feet thick) are found, then a groundwater sample will be collected from the interval immediately above it. The boring will not be advanced through a significant clay unit.

SAP Worksheet #18.2 – Soil Sampling Locations and Methods/SOP Requirements Table

Sampling Location	ID Number ¹	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Sampling Location Rationale ²
38S010	38SS010-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Approximately 30 feet north of 38S006 (Removed Gravel Sump)
	38SS010-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB010-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
38S011	38SS011-000x	Soil	0 to 0.5	Metals	1 + duplicate	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Approximately 30 feet east of 38S006 (Removed Gravel Sump)
	38SS011-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1 + duplicate		
	38SB011-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1 + duplicate		
38S012	38SS012-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS3000	Approximately 30 feet south of 38S006 (Removed Gravel Sump)
	38SS012-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB012-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		

Sampling Location	ID Number ¹	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Sampling Location Rationale ²
38S013	38SS013-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Approximately 30 feet northeast of 38S009 (Gravel Drain)
	38SS013-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB013-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
38S014	38SS014-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Approximately 30 feet east of 38S009 (Gravel Drain)
	38SS014-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB014-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
38S015	38SS015-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Approximately 30 feet south of 38S009 (Gravel Drain)
	38SS015-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB015-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		

Sampling Location	ID Number ¹	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Sampling Location Rationale ²
38S016	38SS016-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Anticipated Background/ Upgradient Location
	38SS016-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB016-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
38S017	38SS017-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Drainage Ditch North of PSC 38
	38SS017-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB017-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
38S018	38SS018-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Drainage Ditch East of PSC 38
	38SS018-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB018-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		

Sampling Location	ID Number ¹	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Sampling Location Rationale ²
38S019	38SS019-000x	Soil	0 to 0.5	Metals	1	CT-04, CT-05, SA-6.3, SA-7.1, FS 3000	Drainage Ditch South of PSC 38
	38SS019-0x02	Soil	0.5 to 2	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		
	38SB019-NNNN	Soil	2 to 4 ³	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	1		

¹The ID number consists of, in order, 38 for PSC 38; SS for surface soil, SB for subsurface soil, GW for groundwater, SW for surface water,; and then the number of the sample, 010 for soil (soil samples 001-009 were collected previously). For soil samples, the depth will also need to be included at the end of the ID. NNNN stands for the depth of the sample collected, and "0x" will be used to represent 0.5. For example, subsurface soil sample taken at a depth of 2-4 feet would be 38SB0100204. The duplicate samples will be identified by adding a D at the end of the ID number; therefore, it would be 38SB0100204D. Further definitions for sample nomenclature can be found in Tetra Tech SOP CT-04 included in Appendix C.

² Refer to the Project Sampling SOP References Table (see Worksheet #21).

³ Depth of the subsurface soil sample is the 2-foot interval with the highest PID reading, or the 2-foot interval just above the top of water table, if there are no volatile organics detected by PID.

SAP Worksheet #19 – Analytical SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference ⁽¹⁾	Sample Size	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil	VOCs	SW-846 5035/8260B, Empirical SOP-202/225	5 grams (g)	Three 40-milliliter (mL) terracores	Sodium bisulfate/methanol; cool to < 6°C or water/ methanol freeze to < -10°C	14 days to analysis
Groundwater	VOCs	SW-846 5030/8260B, Empirical SOP-202	5 mL	Three 40-mL glass volatile vials	Hydrochloric acid to a pH<2; Cool to < 6°C; no headspace	14 days to analysis
Soil	SVOCs/Low Level PAHs	SW-846 3546/8270C Empirical SOP-201/343	15 g	One 4-ounce (oz) glass jar	Cool to < 6°C	14 days until extraction/ 40 days to analysis
Groundwater	SVOCs/Low Level PAHs	SW-846 3510C/3520/8270C Empirical SOP-201/300	1000 mL	Two 1-liter (L) glass amber bottles	Cool to < 6°C	7 days until extraction/ 40 days to analysis
Soil	Pesticides/ PCBs	SW-846 3540/3545/ 3550/8081A/8082B, Empirical SOP-211/343	30 g	4-oz glass jar	Cool to < 6°C	14 days until extraction/ 40 days to analysis
Groundwater	Pesticides/ PCBs	SW-846 3510C/ 3520/8081A/8082B, Empirical SOP-211/302	1000 mL	Two 1-L glass amber bottles	Cool to < 6°C	7 days until extraction/ 40 days to analysis
Soil	Metals	SW-846 3050B/ 6010C, Empirical SOP-100/104/105	1-2 g ICP/ 0.3 g mercury	One 4-oz glass	Cool to < 6°C	180 days to analysis, except for 28 days for mercury
Groundwater	Metals	SW-846 3010A/ 6010C, Empirical SOP-100/103/105	50 mL ICP/ 30 mL mercury	One 500 mL plastic bottle	Nitric acid to a pH<2; Cool to < 6°C	180 days to analysis, except for 28 days for mercury

¹ Laboratory SOPs are subject to revision and updates during duration of the project. The laboratory will use the most current revision of the SOP at the time of analysis.

SAP Worksheet #20 – Field QC Sample Summary Tables
(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	No. of Phase I Sampling Locations ¹	No. of Field Duplicates	No. of MS/MSDs ²	No. of Field Blanks ³	No. of VOC Trip Blanks ⁴	No. of Equip. Blanks	Total No. of Samples to Lab
Groundwater	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	10	1	1/1	1	4	1	17
Surface Soil (0 to 6 inches)	Metals	10	1	1/1	0	NA	1	12
Surface Soil (6 inches to 2 feet)	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	10	1	1/1	0	0	1	12
Subsurface Soil (2 to 4 feet)	VOCs, SVOCs and Low Level PAHs, PCBs, Pesticides, Metals	10	1	1/1	0	0	1	12

- 1 If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.
- 2 Although the Matrix Spike/ Matrix Spike Duplicate (MS/MSD) (or MS/sample duplicate for metals) are not typically considered field QC samples and are not included in the "Total No. of Samples to Lab", they are included here because location determination is often established in the field.
- 3 Field Blanks (source water blanks) will be analyzed once per source water for VOCs and Metals only and will be submitted with groundwater samples.
- 4 Trip Blanks will only be analyzed for VOCs and will only be submitted with groundwater samples (one per cooler of aqueous VOC samples).

SAP Worksheet #21 – Project Sampling SOP References Table
(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and/or Number ¹	Originating Organization of Sampling SOP ¹	Equipment Type	Modified for Project Work? (Y/N)	Comments
CT-04	Sample Nomenclature (Revision 2, 03/09/09)	Tetra Tech	NA	N	Field SOPs are contained in Appendix C. FDEP SOPs are also available through their website.
CT-05	Database Records and Quality Assurance (Revision 2, 01/29/01)	Tetra Tech	NA	N	
FC 1000	Cleaning/Decontamination Procedures, 2008	FDEP	Decontamination Equipment (scrub brushes, phosphate free detergent, DI water)	N	
FD 1000	Documentation Procedures, 2008	FDEP	Documentation of all sampling activities (log book, sampling logs, chain-of-custodies)	N	
FS 1000	General Sampling Procedures, 2008	FDEP	NA	N	
FS 2000	General Aqueous Sampling March 31, 2008 (Effective 12/3/08)	FDEP	NA	N	
FS 2200	Groundwater March 31, 2008 (Effective 12/3/08)	FDEP	NA	N	
FS 2212	Well Purging Techniques, 2008	FDEP	NA	N	
FS 2220	Groundwater Sampling Techniques, 2008	FDEP	NA	N	
FS 3000	Soil March 31, 2008 (Effective 12/3/08)	FDEP	NA	N	

Reference Number	Title, Revision Date and/or Number ¹	Originating Organization of Sampling SOP ¹	Equipment Type	Modified for Project Work? (Y/N)	Comments
GH-1.5	Borehole and Sample Logging (Revision 1, June, 1999)	Tetra Tech	General field supplies	N	
HS-1.0	Utility Locating and Excavation Clearance (Revision 2, December, 2003)	Tetra Tech	Remote subsurface sensing, magnetometer, etc.	N	
SA-1.3	Soil Sampling (Revision 9, 04/07/08)	Tetra Tech	Field log book, sample log sheets, boring logs	N	
SA-2.5	Direct Push Technology (Geoprobe®/Hydropunch™) (Revision 3, September, 2003)	Tetra Tech	DPT Rig, accessories, and supplies	N	
SA-6.3	Field Documentation (Revision 3, 03/09/09)	Tetra Tech	Field log book, sample log sheets, boring logs	N	
SA-7.1	Decontamination of Field Equipment (Revision 6, 01/28/09)	Tetra Tech	Decontamination equipment, scrub brushes, 5-gallon buckets, spray bottles, phosphate-free detergent, deionized water	N	SOP written specifically for this project. Contained in Appendix C.
SOP-01	Global Positioning System (Revision 1, July, 2010)	Tetra Tech	GPS unit	Y	

¹ FDEP Field SOPs can be obtained at the following website: <http://www.dep.state.fl.us/labs/qa/sops.htm>

SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity ¹	Frequency	Acceptance Criterion	Corrective Action	Responsible Person	SOP Reference ²	Comments
DPT / Backhoe / Excavating Machinery	Inspection	Daily	Equipment Inspection Sheet Criteria	Operator correction or replacement	Tetra Tech FOL or designee	FS 3000, GA-1.5, SA-2.5	None
Disposable Hand Trowel – Soil Sampling	Inspection	Per Use	NA	Replace	Tetra Tech FOL or designee	FS 3000, GA-1.5, SA-2.5	None
PID	Visual Inspection Calibration/ Verification	Daily Beginning and end of day	Manufacturer's Guidance	Operator correction or replacement	Tetra Tech FOL or designee	SA-1.3, GH-1.5, SA-2.8, Manufacturer's Guidance Manual	To be used to determine the soil boring depth that is most impacted for biased sample collection.
GPS	Positioning	Beginning and end of each day used	Accuracy: sub-meter horizontal dilution of precision < 3, number of satellites must be at least six	Wait for better signal, replace unit, or choose alternate location technique	Tetra Tech FOL or designee	SOP-01	None

1 Activities may include calibration, verification, testing, maintenance, and/or inspection.

2 Specify the appropriate reference letter or number from the Project Sampling SOP References Table (Worksheet #21).

SAP Worksheet #23 – Analytical SOP References Table
(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?1 (Y/N)
Empirical SOP-100	Metals Digestion/ Preparation, Methods 3005A/ USEPA Contract Laboratory Program (CLP) ILMO 4.1 Aqueous, 3010A, 3030C, 3050B, USEPA CLP ILMO 4.1 (Soil/Sediment), 200.7, Standard Methods 3030C (Revision 21, 09/01/10)	Definitive	Soil, groundwater, and aqueous QC samples/metals digestion	Natural Attenuation/ Preparation	Empirical	N
Empirical SOP-103	Mercury Analysis in Water by Manual Cold Vapor Technique Methods SW846 7470A & 245.1, CLP-M 4.1 (Revision 18, 04/11/10)	Definitive	Groundwater and aqueous QC samples/mercury	Flow Injection Mercury Analyzer	Empirical	N
Empirical SOP-104	Mercury Analysis in Soil/Sediment by Manual Cold Vapor Technique Methods SW846 7471A, 7471B, & 245.5, CLP-ILM 4.1 (Revision 19, 04/11/10)	Definitive	Soil /mercury	Flow Injection Mercury Analyzer	Empirical	N
Empirical SOP-105	Metals by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) Technique, SW-846 Methods 6010B, 6010C, USEPA Method 200.7, Standard Methods 19th Edition 2340B, USEPA CLP ILMO 4.1 (Revision 16, 04/11/10)	Definitive	Soil, groundwater, and aqueous QC samples/ Metals	ICP –AES	Empirical	Y antimony and thallium will be concentrated 4 X
Empirical SOP-201	Gas Chromatography/ Mass Spectroscopy (GC/MS) Semivolatiles by Method 625 and SW846 Method 8270C and 8270D (Revision 20, 04/26/10)	Definitive	Soil, groundwater, and aqueous QC samples/ SVOCs	GC/MS	Empirical	N
Empirical SOP-202	GC/MS Volatiles using USEPA Method 624 and SW846 Method 8260B, Including Appendix IX Compounds (Revision 23, 09/09/10)	Definitive	Soil, groundwater, and aqueous QC samples/VOCs	GC/MS	Empirical	N

SAP Worksheet #23 – Analytical SOP References Table (Continued)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? ¹ (Y/N)
Empirical SOP-211	Gas Chromatography/ Electron Capture Detector (GC/ECD) Organochlorine Pesticides/ PCBs using USEPA Method 608/608.2 or SW846 Method 8081A/8082 or 8081B/8082A (Revision 22, 07/07/10)	Definitive	Soil, groundwater, and aqueous QC samples/Pesticides and PCBs	GC/ECD	Empirical	N
Empirical SOP-225	GC/MS Volatile Non-Aqueous Matrix Extraction using SW-846 Method 5035 for 8260B Analysis (Revision 9, 9/07/10)	Definitive	Soil / VOCs extraction	GC/MS	Empirical	N
Empirical SOP-300	GC/MS Semivolatile BNA-Aqueous Matrix Extraction Using SW-846 Method 3510C for 8270C/625 Analysis (Revision 18, 04/23/10)	Definitive	Groundwater and aqueous QC samples/SVOCs extraction	Natural Attenuation/ Extraction	Empirical	N
Empirical SOP-302	Pesticide/PCBs- Aqueous Matrix Extraction for USEPA 608 and SW846 Method 8081A/8082 Using Method 3510C (Revision 17, 04/26/10)	Definitive	Groundwater and aqueous QC samples/Pesticides, and PCBs extraction	Natural Attenuation/ Extraction	Empirical	N
Empirical SOP-343	BNA, Pesticide/PCB, and TPH Non-Aqueous Matrix (Microwave Extraction) Using SW-846 Method 3546 (Revision 1, 09/09/10)	Definitive	Soil / SVOCs, Pesticides, and PCBs Extraction	NA/ Extraction	Empirical	N
Empirical SOP-QS-10	Laboratory Sample Receiving Log-in and Storage Standard Operating Procedures (Revision 14, 09/07/10)	NA	Log-in	NA/ Log-in	Empirical	N
Empirical SOP-QS-14	Analytical Laboratory Waste Disposal (Revision 6, 08/31/10)	Definitive	Disposal	NA / Disposal	Empirical	N

Copies of all the SOPs listed are available for review.

SAP Worksheet #24 – Analytical Instrument Calibration Table
(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS VOCs	Bromofluoro-benzene (BFB) Tune	Prior to each Initial Calibration (ICAL) and at the beginning of each 12-hour period.	Must meet the ion abundance criteria required by the method (SW-846 8260B; Section 7.3.1; Table 4)	Retune and/or clean or replace source. No samples may be accepted without a valid tune.	Analyst/ Supervisor	Empirical SOP-202
	ICAL – a minimum of a 5-point calibration is prepared for all target analytes	Upon instrument receipt, for major instrument changes, or when continuing calibration verification (CCV) does not meet criteria.	The average response factor (RF) for System Performance Check Compound (SPCCs) must be ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. The percent relative standard deviation (%RSD) for RFs for calibration check compounds (CCCs) must be $\leq 30\%$; and %RSD for each target analyte must be $\leq 15\%$, or the linear regression correlation coefficient (r) must be ≥ 0.995 ; or the coefficient of determination (r^2) must be ≥ 0.99 (6 points are required for second order).	Correct problem then repeat ICAL. No samples may be run until ICAL has passed.	Analyst/ Supervisor	
	Retention Time (RT) Window Position Establishment	Once per ICAL for each analyte and surrogate.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA.	Analyst / Supervisor	
	Evaluation of Relative Retention Times (RRTs)	With each sample.	RRT of each target analyte must be within ± 0.006 RRT units.	Correct problem, then rerun ICAL.	Analyst / Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS VOCs (Continued)	Initial Calibration Verification (ICV) – Second Source	Once after each ICAL, prior to beginning a sample run.	The percent recovery (%R) for all target analytes must be within 80-120% of true value.s	Correct problem and verify ICV. If that fails, correct problem and repeat ICAL. No samples may be run until ICV has been verified.	Analyst/ Supervisor	Empirical SOP-202
	Initial Calibration Verification (ICV) – Second Source	Once after each ICAL, prior to beginning a sample run.	The percent recovery (%R) for all target analytes must be within 80-120% of true values.	Correct problem and verify ICV. If that fails, correct problem and repeat ICAL. No samples may be run until ICV has been verified.	Analyst/ Supervisor	
	CCV	Perform one per 12-hour analysis period after tune and before sample analysis.	The minimum RF for SPCCs must be ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. The percent difference or percent drift (%D) for all target analytes and surrogates must be $\leq 20\%$.	Correct problem and rerun CCV. If that fails, repeat ICAL and reanalyze all samples analyzed since the last successful CCV.	Analyst/ Supervisor	
GC/MS SVOCs and Low Level PAHs	Tune Verification – decafluoro-triphenyl-phosphine	Prior to each ICAL and at the beginning of each 12-hour analytical sequence.	Must meet the ion abundance criteria required by the method (SW-846 8270C; Section 7.3.1; Table 3), DDT degradation $< 20\%$ (exclusion for Low Level PAH analysis).	Retune and/or clean or replace source. No samples may be accepted without a valid tune.	Analyst/ Supervisor	Empirical SOP-201
	Breakdown Check (DDT only)	At the beginning of each 12-hour analytical sequence.	The degradation must be $\leq 20\%$ for DDT to verify inertness of the injection port.	Correct the problem then repeat breakdown check. No samples shall be run until degradation is $\leq 20\%$ for DDT.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS SVOCs and Low Level PAHs (Continued)	ICAL – A minimum of a 5-point calibration is prepared for all target analytes	Upon instrument receipt, instrument change (new column, source cleaning, etc.), when CCV is out of criteria.	1. Average RF for SPCCs must be greater than or equal to 0.050 [2,4-dinitrophenol, hexachlorocyclopentadiene, N-Nitrosodipropylamine, 4-nitrophenol] Note 2: > 0.050 for all low-level PAHs 2. RSD for RFs for CCCs: SVOCs _ 30% and one option below: Option 1: RSD for each analyte _ 15%; Option 2: linear least squares regression r _ 0.995 or r ² _ 0.990; Option 3: non-linear regression–coefficient of determination r ² _ 0.990 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat ICAL. No samples may be run until ICAL has passed.	Analyst/ Supervisor	Empirical SOP-201
	ICV – Second Source	Perform after each ICAL, prior to beginning a sample run.	The %R of all target analytes must be within 80-120% of the true value.	Correct problem and verify ICV. If that fails, correct problem and repeat ICAL. No samples may be run until ICV has been verified.	Analyst/ Supervisor	
	RT Window Position Establishment	Once per ICAL for each analyte and surrogate.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA.	Analyst / Supervisor	
	Evaluation of RRTs	With each sample.	RRT of each target analyte must be within ± 0.006 RRT units.	Correct problem, then rerun ICAL.	Analyst / Supervisor	
	CCV	Analyze a standard at the beginning of each 12-hour shift after tune and before sample analysis.	1. Average RF for SPCCs must be greater than or equal to 0.050 [2,4-dinitrophenol, hexachlorocyclopentadiene, N-Nitrosodipropylamine, 4-nitrophenol] and > 0.050 for all low-level PAHs 2. %D for all target compounds and surrogates %D must less than 20%.	If %D is high and sample result is ND, qualify/narrate with project approval. If %D is low or project approval not received, reanalyze all samples since the last successful CCV.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/ECD Pesticides	Breakdown Check – Endrin/DDT	At the beginning of each 12 hour period, prior to analysis of samples.	The degradation must be $\leq 15\%$ for both DDT and Endrin to verify the inertness of the injection port.	Correct the problem then repeat breakdown check. No samples shall be run until degradation is $\leq 15\%$ for both DDT and Endrin.	Analyst/	Empirical SOP-211
	ICAL – A minimum of a 5-point calibration of individual pesticides, with a mid-point calibration of toxaphene and chlordane, is prepared for all target analytes	Upon instrument receipt, major instrument change, or when the CCV does not meet criteria, prior to sample analysis.	The %RSD for RFs for each target analyte must be $\leq 20\%$, or r must be ≥ 0.995 , or r^2 must be ≥ 0.99 (minimum of 6 points required for second order).	Correct problem and repeat ICAL. If a single-point calibration for toxaphene or chlordane is used and toxaphene or chlordane is identified in analysis of a sample, a minimum of a 5-point ICAL of the identified compound with reanalysis of sample must be performed. No samples may be run until ICAL has passed.	Analyst/ Supervisor	
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R of all target analytes must be within 80-120% of true value.	Correct problem and verify ICV. If that fails, correct problem and repeat ICAL. No samples may be run until ICV has been verified.	Analyst/ Supervisor	
	CCV	Analyze standard at the beginning and end of sequence and after every 10 samples.	The %D of all target analytes must be $\leq 20\%$.	If %D is high and sample result is ND, qualify/narrate with project approval. If %D is low or project approval not received, reanalyze all samples since the last successful CCV.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/ECD PCBs	ICAL - A minimum of a 5-point calibration of Aroclor 1660 (1016/1260 mixture) is prepared	Upon instrument receipt, major instrument change, when CCV does not meet criteria.	Option 1: %RSD must be $\leq 20\%$ for Aroclor 1016/1260. If not met, Option 2: r must be ≥ 0.995 ; or Option 3: r^2 must be ≥ 0.99 for 6-point calibration. Mid-point calibration of other Aroclors – if an Aroclor is detected in a sample, a minimum of 5-point ICAL must be performed and meet the above criteria.	Correct problem then repeat ICAL. No samples may be run until ICAL has passed.	Analyst/ Supervisor	Empirical SOP-211
	ICV – Second Source	Once after each ICAL prior to sample analysis.	The %R of all target analytes must be within 80-120% of true value.	Evaluate, repeat, if still failing, recalibrate.	Analyst/ Supervisor	
	CCV	Analyze standard at the beginning and end of sequence and after every 10 samples.	The %D of all target analytes must be $\leq 20\%$.	If %D is high and sample result is ND, qualify/narrate with project approval. If %D is low or project approval not received, reanalyze all samples since the last successful CCV.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
ICP-AES Metals	ICAL - a 1-point calibration per manufacturer's guidelines is prepared for all target analytes	At the beginning of each day, or if the QC is out of criteria, prior to sample analysis.	None; only one high standard and a calibration blank must be analyzed. If more than one calibration standard is used, Linear calibration Corr. of 0.998.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-105
	ICV – Second Source	Following ICAL, prior to the analysis of samples.	The %R must be within 90-110% of true value.	Investigate reasons for failure, reanalyze once. If still unacceptable, correct problem and repeat ICAL.	Analyst/ Supervisor	
	CCV	At the beginning and end of the sequence and after every 10 samples.	The %R must be within 90-110% of true value.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze all affected samples.	Analyst/ Supervisor	
	Initial Calibration Blank (ICB)	Before beginning a sample sequence.	No analytes detected > than the LOD.	Correct the problem, then re-prepare and reanalyze.	Analyst / Supervisor	
	Continuing Calibration Blank (CCB)	After the initial CCV, after every 10 samples, and at the end of the sequence.	No analytes detected > than the LOD.	Correct the problem, then re-prepare and reanalyze calibration blank and all affected samples.	Analyst / Supervisor	
	Low-Level Check Standard (if using 1-point ICAL)	Daily after 1-point ICAL and before samples.	The %R must be within 80-120% of true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze all affected samples.	Analyst / Supervisor	
	Interference Check Standards (ICS – ICS A and ICS B)	At the beginning of an analytical run.	ICS A recoveries must be within the absolute value of the LOD; and ICS B recoveries must be within 80-120 %R of true value.	Terminate analysis; locate and correct problem; reanalyze ICS.	Analyst / Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
Cold Vapor Atomic Absorption (CVAA) Mercury	ICAL – A minimum of a 7-point calibration is prepared.	Perform daily prior to sample analysis.	The %RSD for RFs must be $\leq 20\%$, or r must be ≥ 0.995 .	Correct problem then repeat ICAL. No samples may be run until ICAL has passed.	Analyst/ Supervisor	Empirical SOP-103/104
	ICB	Before beginning a sample sequence.	No mercury detected > LOD.	Correct problem, then re-prepare and reanalyze.	Analyst / Supervisor	
	ICV - Second Source	Once after each ICAL and prior to sample analysis	The %R must be within 90-110% of the true value.	Correct problem and verify ICV. If that fails, correct problem and repeat ICAL. No samples may be run until ICV has been verified.	Analyst / Supervisor	
	CCB	After each CCV, after every 10 samples, and at the end of the sequence	No mercury detected > LOD.	Investigate source of contamination, rerun any samples not bracketed by passing blanks.	Analyst / Supervisor	
	CCV	At beginning and end of each run sequence and every 10 samples.	The %R must be within 80-120% of the true value.	Correct problem and rerun CCV. If that fails, repeat ICAL and reanalyze all samples analyzed since the last successful CCV.	Analyst / Supervisor	

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.2.3)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference ⁽¹⁾
GC/MS	Check pressure and gas supply daily. Bake out trap and column, change septa as needed, cut column as needed, change trap as needed. Other maintenance specified in Equipment Maintenance SOP.	VOCs/ SVOCs and Low Level PAHs	Ion source, injector liner, column, column flow, purge lines, purge flow, trap.	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	Analyst/ Supervisor	Empirical SOP- 201/202
GC/ECD	Check pressure and gas supply daily. Bake out column, change septa and/or liner as needed, replace or cut column as needed. Other maintenance specified in Equipment Maintenance SOP.	Pesticides/ PCBs	Injector liner, septas, column, column flow.	Prior to ICAL and/or as necessary.	Acceptable ICAL and CCV.	If % D > 20% and samples are < LOD, narrate. If %D > 20% only on one column, narrate. If % D > 20% for closing CCV, and is likely due to matrix interference, narrate. Otherwise, reanalyze all samples since the last acceptable CCV.	Analyst/ Supervisor	Empirical SOP-211
ICP-AES	Clean the torch assembly and the spray chamber when they become discolored or when degradation in data quality is observed. Clean the nebulizer, and check the argon supply. Replace the peristaltic pump tubing as needed.	Metals (Except Mercury)	Inspect the torch, nebulizer chamber, pump, and tubing	Prior to ICAL and as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	Analyst/ Supervisor	Empirical SOP-105
CVAA	Replace peristaltic pump tubing, replace mercury lamp, replace drying tube, clean optical cell and/or clean liquid/gas separator as needed. Other maintenance specified in Equipment Maintenance SOP.	Mercury	Inspect the tubing, filter, and the optical cell	Prior to ICAL and as necessary.	Acceptable ICAL and CCV.	Correct the problem and repeat ICAL or CCV.	Analyst/ Supervisor	Empirical SOP- 103/104

Notes:

¹ Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

SAP Worksheet #26 – Sample Handling System
 (UFP-QAPP Manual Appendix A)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Tetra Tech FOL or designee/ Tetra Tech
Sample Packaging (Personnel/Organization): Tetra Tech FOL or designee/ Tetra Tech
Coordination of Shipment (Personnel/Organization): Tetra Tech FOL or designee/ Tetra Tech
Type of Shipment/Carrier: Federal Express
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodians/ Empirical
Sample Custody and Storage (Personnel/Organization): Sample Custodians/ Empirical
Sample Preparation (Personnel/Organization): Organics Extraction/Metals Prep Labs/ Empirical
Sample Determinative Analysis (Personnel/Organization): GC, GC/MS, Metals/ Empirical
Sample Archiving
Field Sample Storage (No. of days from sample collection): 60 days from receipt
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 90 days from sample digestion/extraction
Biological Sample Storage (No. of days from sample collection): NA
Sample Disposal
Personnel/Organization): Sample Custodians/ Empirical

SAP Worksheet #27 – Sample Custody Requirements Table (UFP-QAPP Manual Section 3.3.3)

27.1 SAMPLE NOMENCLATURE, SAMPLE COLLECTION DOCUMENTATION, HANDLING, TRACKING, AND CUSTODY PROCEDURES

The following sections outline the procedures that will be used to document project activities and sample collection, handling, tracking, and custody procedures during the investigation. All forms must be filled in as completely as possible.

27.1.1 Sample Identification

Refer to Worksheet #18 for how the samples will be labeled. Also, refer to Worksheet #20 for how the field QA/QC samples will be labeled.

27.1.2 Sample Collection Documentation

Documentation of field observations will be recorded in a field logbook and/or field log sheets including sample collection logs, boring logs, and monitoring well construction logs. Field logbooks utilized on this project will consist of a bound, water-resistant logbook. All pages of the logbook will be numbered sequentially and observations will be recorded with indelible ink.

Field sample log sheets will be used to document sample collection details, and other observations and activities will be recorded in the field logbook. Instrument calibration logs will be used to record the daily instrument calibration. Example field forms are included in Appendix C.

For sampling and field activities, the following types of information will be recorded in the field log as appropriate:

- Site name and location
- Date and time of logbook entries
- Personnel and their affiliations
- Weather conditions
- Activities involved with the sampling
- Subcontractor activity summary
- Site observations including site entry and exit times
- Site sketches made on site

- Visitor names, affiliations, arrival and departure times
- Health and safety issues, including PPE

27.1.3 Sample Handling and Tracking System

Following sample collection into the appropriate bottle ware, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble-wrap in order to protect the bottle ware during shipment. The cooler will be secured using strapping tape along with a signed custody seal. Sample coolers will be delivered to a local courier location for priority overnight delivery to the selected laboratory for analysis. Samples will be preserved as appropriate based on the analytical method. The laboratories will provide pre-preserved sample containers for sample collection. Samples will be maintained at 0 to 6 °C until delivery to the laboratory. Proper custody procedures will be followed throughout all the stages and phases of sample collection and handling.

After collection, each sample will be maintained in the sampler's custody until formally transferred to another party (e.g., Federal Express). For all samples collected, chain-of-custody forms will document the date and time of sample collection, the sampler's name, and the names of all others who subsequently held custody of the sample. Specifications for chemical analyses will also be documented on the chain-of-custody form. FDEP SOP FD 1000 and Tetra Tech SOP SA-6.3 (see Appendix C) provide further details on the chain-of-custody procedure.

These subsections outline the procedures that will be used by field and laboratory personnel to document project activities and sample collection procedures during this Phase I RI. All forms must be filled in as completely as possible.

27.1.4 Sample Handling

Sample handling requirements are described in Worksheet #26. Tetra Tech personnel will collect the samples. The samplers will take care not to contaminate samples through improper handling. Samples will be sealed in appropriate containers, packaged by Tetra Tech personnel, and placed into sealed coolers under chain-of-custody in accordance with the applicable SOP (See Worksheet #21). Aqueous samples to be analyzed for VOCs will be accompanied by a VOC trip blank. All coolers will contain a temperature blank. Samples will be transferred under chain-of-custody to a courier as described below. Once received by the laboratory, receipt will be documented on the chain-of-custody form and the samples will be checked in. The samples will remain under chain-of-custody throughout the analysis period to ensure their integrity is preserved. Details are provided below.

27.1.5 Sample Delivery

Samples to be delivered to the laboratory will be made by a public courier (i.e., Federal Express). After samples have been collected, they will be sent to the laboratory within 24 hours. Under no circumstances will sample holding times be exceeded.

27.1.6 Sample Custody

Chain-of-custody protocols will be used throughout sample handling to establish the evidentiary integrity of sample containers. These protocols will be used to demonstrate that the samples were handled and transferred in a manner that would eliminate possible tampering. Samples for the laboratory will be packaged and shipped in accordance with FDEP SOP FS 1000 and Tetra Tech SOP SA-6.1 (see Appendix C).

A sample is under custody if any of the following occur:

- The sample is in the physical possession of an authorized person.
- The sample is in view of an authorized person after being in his/her possession.
- The sample is placed in a secure area by an authorized person after being in his/her possession.
- The sample is in a secure area, restricted to authorized personnel only.

Custody documentation is designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. A multi-part form is used with each page of the form signed and dated by the recipient of a sample or portion of sample. The person releasing the sample and the person receiving the sample each will retain a copy of the form each time a sample transfer occurs.

Integrity of the samples collected during the site investigation will be the responsibility of identified persons from the time the samples are collected until the samples, or their derived data, are incorporated into the final report.

The Tetra Tech FOL is responsible for the care and custody of the samples collected until they are delivered to the laboratory or are entrusted to a carrier. When transferring samples, the individuals relinquishing and receiving them will sign, date, and note the time on the chain-of-custody form. This record documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common carrier). Upon arrival at the laboratory, internal sample custody procedures will be followed as defined in the Laboratory SOPs.

27.1.7 Laboratory Custody

Laboratory sample custody procedures (receipt of samples, archiving, and disposal) will be used according to Empirical SOPs. Coolers are received and checked for proper temperature. A sample cooler receipt form will be filled out to note conditions and any discrepancies. The chain-of-custody form will be checked against the sample containers for accuracy. Samples will be logged into the Laboratory Information Management System and given a unique log number that can be tracked through processing. The Laboratory PM will notify the Tetra Tech FOL verbally or via e-mail of any problems on the same day that an issue is identified.

SAP Worksheet #28 – Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Soil, Groundwater, and Aqueous Field QC Samples					
Analytical Group	VOCs					
Analytical Method / SOP Reference	SW-846 8260B/ Empirical SOP-202					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per preparatory batch of 20 or fewer samples.	No target compound concentrations may be > ½ the LOQ, except common laboratory contaminants methylene chloride, cyclohexane, acetone, and 2-Butanone may be present, but must be < LOQ.	Investigate source of contamination and rerun method blank prior to analysis of samples, if possible. Evaluate the samples and associated QC: if blank results are above LOQ, then report sample results which are <LOQ or >10X the blank concentration. Re-prepare and reanalyze blank and those samples that were >LOQ and <10X the blank.	Analyst, Supervisor, Data Validator	Bias/ Contamination	Same as QC Acceptance Limits.
Laboratory Control Sample (LCS)	One is performed for each batch of up to 20 samples.	%Rs must meet the DoD Quality Systems Manual (QSM) Version 4.1 limits as per Appendix G of the DoD QSM. If laboratory control sample duplicate (LCSD) performed - The RPD between LCS and LCSD must be ≤ 30%.	Evaluate and reanalyze if possible. If an MS/MSD was performed in the same 12-hour clock and acceptable, then narrate. If the LCS %Rs are high, but the sample results are <LOQ, then narrate. Otherwise, re-prepare and reanalyze.	Analyst, Supervisor, Data Validator	Accuracy	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, Groundwater, and Aqueous Field QC Samples					
Analytical Group	VOCs					
Analytical Method / SOP Reference	SW-846 8260B/ Empirical SOP-202					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS/MSD	One per sample delivery group (SDG) or every 20 samples of similar matrix.	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM. The RPD between MS and MSD should be $\leq 30\%$.	Corrective actions will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD %Rs are unacceptable, then re-prepare the samples and QC.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.
Internal Standard (IS)	Three per sample- Fluorobenzene Chlorobenzene-d5 1,4-dichlorobenzene-d4	RTs for ISs must be within ± 30 seconds and the response areas must be within -50% to +100% of the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	Inspect mass spectrometer or gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
Surrogate	Four per sample: Dibromofluoromethane 1,2-dichloroethane-d4 Toluene-d8 BFB	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM.	If sample volume is available, then re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Supervisor, Data Validator	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil, Groundwater, and Aqueous Field QC Samples					
Analytical Group	VOCs					
Analytical Method / SOP Reference	SW-846 8260B/ Empirical SOP-202					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Results between DL and LOQ	NA	Apply "J" qualifier to results detected between DL and LOQ.	NA	Analyst, Supervisor, Data Validator	Accuracy	Same as QC Acceptance Limits.

Matrix	Soil, Groundwater, and Aqueous QC Samples					
Analytical Group	SVOCs and Low Level PAHs					
Analytical Method / SOP Reference	SW-846 8270C, 8270C-Low/ Empirical SOP-201					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per preparation batch of 20 or fewer samples of similar matrix	No target compounds should be > ½ the LOQ except common laboratory contaminants, which should be, no target compounds should be > the LOQ.	(1) Investigate source of contamination (2) Re-prepare and analyze method blank and all samples processed with the contaminated blank.	Analyst, Supervisor, Data Validator	Bias/ Contamination	Same as QC Acceptance Limits.
LCS LCSD (not required)	One is performed for each batch of up to 20 samples	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM. RPD ≤30% (for LCS/LCSD)	Evaluate and reanalyze if possible. If an MS/MSD was performed in the same 12 hour clock and is acceptable, then narrate. If the LCS recoveries are high but the sample results are <LOQ, then narrate. Otherwise, re-prepare and reanalyze.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.
MS/MSD	One per preparatory batch of 20 or fewer samples of similar matrix.	%Rs should meet the Empirical statistically-derived limits. The RPD between MS and MSD should be ≤ 30%.	Corrective action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met, unless RPDs indicate obvious extraction/ analysis difficulties, then re-prepare and reanalyze MS/MSD.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.

Matrix	Soil, Groundwater, and Aqueous Field QC Samples					
Analytical Group	SVOCs and Low Level PAHs					
Analytical Method / SOP Reference	SW-846 8270C, 8270C-Low/ Empirical SOP-201					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
IS	Six per sample – 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	RTs must be within ± 30 seconds and the response areas must be within -50% to +100% of the ICAL midpoint standard for each IS.	Re-analyze affected samples.	Analyst, Supervisor, Data Validator	Accuracy	Same as QC Acceptance Limits.
Surrogates	Six per sample: 2-Fluorophenol Phenol-d6 Nitrobenzene-d5 2-Fluorobiphenyl 2,4,6-Tribromophenol Terphenyl-d14	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM.	(1) Check chromatogram for interference; if found, then flag data. (2) If not found, then check instrument performance; if problem is found, then correct and reanalyze. (3) If still out, then re-extract and analyze sample. (4) If reanalysis is out, then flag data.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.
Results between DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	NA	Analyst, Supervisor, Data Validator	Accuracy	Same as QC Acceptance Limits.

Matrix	Soil, Groundwater, and Aqueous Field QC Samples					
Analytical Group	Pesticides/PCBs					
Analytical Method / SOP Reference	SW-846 8081B, 8082A/ Empirical SOP-211					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per preparatory batch of 20 or fewer samples of similar matrix.	All target analytes must be $\leq \frac{1}{2}$ LOQ.	Investigate source of contamination. Evaluate the samples and associated QC: i.e., if the blank results are above the LOQ, then report sample results that are $<LOQ$ or $> 10X$ the blank concentration. Otherwise, re-prepare a blank and samples $>LOQ$ and $<10X$ LOQ.	Analyst, Supervisor, Data Validator	Bias/ Contamination	Same as QC Acceptance Limits.
LCS	One per preparatory batch of 20 or fewer samples of similar matrix. Pesticide: Spike with single component pesticide mix PCB: Spike with Aroclor 1016/1260 mix	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM. RPD $\leq 30\%$ (for LCS/LCSD).	If an MS/MSD was performed and is acceptable, then narrate. If an LCS/LCSD was performed and only one of the set was unacceptable, then narrate. If the LCS recovery is high, but the sample results are $<LOQ$, then narrate. Otherwise, re-extract blank and affected sample batch.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.
MS/MSD	One per preparatory batch of 20 or fewer samples of similar matrix. (spike same as LCS)	%Rs should meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM. The RPD between MS and MSD should be $\leq 30\%$.	Evaluate the samples and associated QC and if the LCS results are acceptable, then narrate. If both the LCS and MS/MSD are unacceptable, then re-prepare the samples and QC.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.

Matrix	Soil, Groundwater, and Aqueous Field QC Samples					
Analytical Group	Pesticides/PCBs					
Analytical Method / SOP Reference	SW-846 8081B, 8082A/ Empirical SOP-211					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogates	Two per sample: Tetrachloro-m-xylene (TCMX) Decachlorobiphenyl	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM.	No corrective action will be taken when one surrogate is within criteria. If surrogates recoveries are high and sample is <LOQ, then no corrective action is taken. If surrogates recoveries are low, then the affected samples are re-extracted and reanalyzed.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.
Results between DL and LOQ	NA	Apply "J" qualifier to results between DL and LOQ.	NA	Analyst, Supervisor, Data Validator	Accuracy	Same as QC Acceptance Limits.
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column must be $RPD \leq 40\%$. For Method 8082, report the higher of the two concentrations, unless there is interference.	None. Apply "J" flag if $RPD > 40\%$ and discuss in the case narrative.	Analyst, Supervisor, Data Validator	Accuracy	Same as QC Acceptance Limits.

Matrix	Soil, Groundwater, and Aqueous Field QC Samples					
Analytical Group	Metals (Including Mercury)					
Analytical Method / SOP Reference	SW-946 6010C, 7470A, 7471A/ Empirical SOP-103, 104, 105					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples	No analytes detected > ½ the LOQ.	If the blank value > LOQ, then report sample results. If the blank value < LOQ or > 10x the blank value; then redigest. If blank value is less than negative LOQ, then report sample results. If > 10x the absolute value of the blank result, then redigest.	Analyst, Supervisor, Data Validator	Bias/ Contamination	Same as QC Acceptance Limits.
LCS	One is performed for each batch of up to 20 samples	%R must be within 80-120% of true value.	Redigest and reanalyze all associated samples for affected analyte.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.
MS	One per 20 samples of similar matrix	The %R should be within 80-120%, if sample < 4x spike added.	Flag results for affected analytes for all associated samples with "N".	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.
Duplicate Sample	One per preparation batch of 20 or fewer samples of similar matrix	R must be within 80-120%. The RPD should be within ≤20% for duplicate samples for both water and soils.	Narrate any results that are outside control limits.	Analyst, Supervisor, and Data Validator	Precision	Same as QC Acceptance Limits.
Serial Dilution (ICP Only)	One per preparatory batch with sample concentration(s) >50x LOD.	The 5-fold dilution result must agree within ±10%D of the original sample result if result is >50x LOD.	Perform post spike addition.	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.

Matrix	Soil, Groundwater, and Aqueous Field QC Samples					
Analytical Group	Metals (Including Mercury)					
Analytical Method / SOP Reference	SW-946 6010C, 7470A, 7471A/ Empirical SOP-103, 104, 105					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Post Spike (ICP Only)	One is performed when serial dilution fails or target analyte concentration(s) in all samples are < 50x LOD.	The %R must be within 75-125% of expected value to verify the absence of an interference. Spike addition should produce a concentration of 10-100x LOQ.	Flag results for affected analytes for all associated samples with "J".	Analyst, Supervisor, Data Validator	Accuracy/ Bias	Same as QC Acceptance Limits.
Results between DL and LOQ	NA.	Apply "J" qualifier to results between DL and LOQ.	NA.	Analyst, Supervisor, Data Validator	Accuracy	Same as QC Acceptance Limits.

SAP Worksheet #29 – Project Documents and Records Table
 (UFP-QAPP Manual Section 3.5.1)

DOCUMENT	LOCATION MAINTAINED
<p>Sample Collection Documents and Records:</p> <ul style="list-style-type: none"> • Field logbook (and sampling notes) • Field sample forms (e.g. boring logs, sample log sheets, drilling logs, etc.) • Chain-of-custody records • Sample shipment airbills • Equipment calibration logs • Photographs • FTMR forms • Field sampling SOPs 	<p>Tetra Tech project file; results will be discussed in the subject document.</p>
<p>Laboratory Documents and Records:</p> <ul style="list-style-type: none"> • Sample receipt/login form • Equipment calibration logs • Sample analysis run logs • Corrective action forms • Reported results for standards, QC checks, and QC samples • Data completeness checklists • Raw data 	<p>Tetra Tech project file; long-term data package storage at third party commercial document storage firm.</p>
<p>Other Documents:</p> <ul style="list-style-type: none"> • HASP • All versions of SAP • All letter and e-mail correspondence with regulatory agencies, including approvals and comments • Field Investigation data package • All version of project reports 	<p>Tetra Tech project file.</p>

SAP Worksheet #30 – Analytical Services Table
(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ ID Numbers	Analytical Method	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Soil, Groundwater, and Aqueous Field QC Samples	VOCs	See Worksheet #18	SW-846 8260B	21 calendar days	Kim Kostzer kkostzer@empirlabs.com Empirical Laboratories, LLC 621 Mainstream Drive, Suite 270 Nashville, TN 37228 (615) 345-1115	NA
	SVOCs (Including Low Level PAHs)		SW-846 8270C, 8270C Low Level			
	Pesticides		SW-846 8081B			
	PCBs		SW-846 8082A			
	Metals		SW-846 6010C, 7470A, 7471A			

SAP Worksheet #31 – Planned Project Assessments Table
 (UFP-QAPP Manual Section 4.1.1)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Action (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Action (title and organizational affiliation)
Laboratory System Audit ¹	Every 2 years	External	DoD ELAP Accrediting Body	DoD ELAP Accrediting Body Auditor	Laboratory QAM or Laboratory Manager, Empirical	Laboratory QAM or Laboratory Manager, Empirical	Laboratory QAM or Laboratory Manager, Empirical

¹ Empirical is DoD ELAP accredited by a recognized Accrediting Body. The DoD ELAP accreditation letter is included in Appendix D.

SAP Worksheet #32 – Assessment Findings and Corrective Action Responses Table
 (UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Laboratory System Audit	Written audit report	Marcia McGinnity, Laboratory QAM, Empirical	Not specified by DoD ELAP Accrediting Body	Letter	DoD ELAP Accrediting Body	Specified by DoD ELAP Accrediting Body

SAP Worksheet #33 – QA Management Reports Table
(UFP QAPP Manual Section 4.2)

Type of Report	Frequency (daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Data Validation Report	Per SDG	Within 3 weeks of receipt of laboratory data	DVM or designee, Tetra Tech	PM, project file, Tetra Tech
Major Analysis Problem identification (Internal Tetra Tech Memorandum)	When persistent analysis problems are detected by Tetra Tech that may impact data usability	Immediately upon detection of problem (on the same day)	CLEAN QAM, Tetra Tech	PM, CLEAN QAM, Program Manager, project file, Tetra Tech
Project Monthly Progress Report	Monthly for duration of the project	Monthly	PM, Tetra Tech	Navy RPM, Navy; PM, CLEAN QAM, Program Manager, project file, Tetra Tech
Laboratory QA Report	When significant plan deviations result from unanticipated circumstances	Immediately upon detection of problem (on the same day)	Laboratory PM, Empirical	PM, project file, Tetra Tech

SAP Worksheet #34 – Verification (Step I) Process Table
(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Chain-of-Custody Forms	The Tetra Tech FOL or designee will review and sign the chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and the sample information is accurate. The forms will be signed by the sampler and a copy will be retained for the project file, the Tetra Tech PM, and the Tetra Tech Data Validators.	Internal	Sampler and FOL, Tetra Tech
	The Empirical Laboratory Sample Custodian will review the sample shipment for completeness, integrity, and sign accepting the shipment. The Tetra Tech Data Validators will check that the chain-of-custody form was signed and dated by the Tetra Tech FOL or designee relinquishing the samples and also by the Laboratory Sample Custodian receiving the samples for analyses.	Internal/ External	1 - Laboratory Sample Custodian, Empirical 2 - Data Validators, Tetra Tech
SAP Sample Tables/ Chain-of-Custody Forms	Verify that all proposed samples listed in the SAP tables have been collected.	Internal	FOL or designee, Tetra Tech
Sample Log Sheets	Verify that information recorded in the log sheets is accurate and complete.	Internal	FOL or designee, Tetra Tech
SAP/ Field Logs/ Analytical Data Packages	Ensure that all sampling SOPs were followed. Verify that deviations have been documented and MPCs have been achieved. Particular attention should be given to verify that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken trail of documented chain-of-custody from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented.	Internal	PM or designee, Tetra Tech
SAP/ Analytical SOPs/ Analytical Data Packages	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Internal	Laboratory QAM, Empirical
SAP/ Laboratory SOPs/ Raw Data/ Applicable Control Limits Tables	Establish that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the Laboratory QAM will contact the Tetra Tech PM verbally or via e-mail for guidance prior to report preparation.	Internal	Laboratory QAM, Empirical
SAP/ Chain-of-Custody Forms	Check that field QC samples listed in Worksheet #20 were collected as required.	Internal	FOL or designee, Tetra Tech

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Electronic Data Deliverables (EDDs)/ Analytical Data Packages	Each EDD will be verified against the chain-of-custody and hard copy data package for accuracy and completeness. Laboratory analytical results will be verified and compared to the electronic analytical results for accuracy. Sample results will be evaluated for laboratory contamination and will be qualified for false positives using the laboratory method/preparation blank summaries. Positive results reported between the DL and the LOQ will be qualified as estimated. Extraneous laboratory qualifiers will be removed from the validation qualifier.	External	Data Validators, Tetra Tech
Analytical Data Packages	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The Laboratory QAM will sign the case narrative for each data package.	Internal	Laboratory QAM, Empirical
	Each data package will be verified for completeness by the Tetra Tech Data Validator. Missing information will be requested by the Tetra Tech Data Validator from the Laboratory PM.	External	Data Validators, Tetra Tech

Notes:

Verification includes field data verification and laboratory data verification. Verification inputs as per Worksheet #34 will be checked.

SAP Worksheet #35 – Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37; page 110 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	SAP/ Sample Log Sheets	Sample Coordinates - Ensure that sample locations are correct and in accordance with the SAP proposed locations. Document any discrepancies in the final report.	PM, FOL, or designee, Tetra Tech
IIa	Chain-of-Custody Forms	Custody - Ensure that the custody and integrity of the samples was maintained from collection to analysis and the custody records are complete and any deviations are recorded. Review that the samples were shipped and store at the required temperature and sample pH for chemically-preserved samples meet the requirements listed in Worksheet #19. Ensure that the analyses were performed within the holding times listed in Worksheet #19.	Project Chemist or Data Validators, Tetra Tech
IIa/IIb	SAP/ Laboratory Data Packages/ EDDs	Ensure that the laboratory QC samples listed in Worksheet #28 were analyzed and that the MPCs listed in Worksheet #12 were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical QC criteria set up for this project were met.	Project Chemist or Data Validators, Tetra Tech
		Check the field sampling precision by calculating the RPD for field duplicate samples. Check the laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; MS/MSDs; and LCS/LCSD, if available.	
		Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis.	
		Review the chain-of-custody forms generated in the field to ensure that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. The Tetra Tech Data Validator will verify that elements of the data package required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed as per Worksheet #36.	

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIb	SAP/ Laboratory Data Packages/ EDDs	Ensure that the LOQs listed in Worksheet #15 were achieved.	Project Chemist or Data Validators, Tetra Tech
		Discuss the impact of matrix interferences or sample dilutions performed because of the high concentration of one or more other contaminants, on the other target compounds reported as non-detected.	
		Summarize deviations from methods, procedures, or contracts in the Data Validation Report. If possible determine the impact of any deviation from sampling or analytical methods and SOPs requirements and matrix interferences effect on the analytical results. Qualify data results based on method or QC deviation and explain all the data qualifications.	
		Ensure that the laboratory QC samples listed in Worksheet #28 were analyzed and that the MPCs listed in Worksheet #12 were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical QC criteria set up for this project were met.	

SAP Worksheet #36 – Analytical Data Validation (Steps IIa and IIb) Summary Table
(UFP-QAPP Manual Section 5.2.2.1) (Figure 37, page 110 UFP-QAPP Manual)

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Soil, Groundwater, and Aqueous Field QC Samples	VOCs, SVOCs (Including Low Level PAHs), Pesticides, and PCBs	SW-846 8260B, 8270C, 8270C Low, 8081B, and 8082A, method specific criteria, DoD QSM criteria, and those criteria listed in Worksheets #12, #15, #24, and #28 will be used. If not included in Worksheets #12, #15, #24, and #28, then the logic outlined in the "USEPA CLP National Functional Guidelines for Organic Data Review" EPA-540/R-99-008 (USEPA, 1999) will be used to apply qualifiers to data.	Data Validation Specialist, Tetra Tech
IIa and IIb	Soil, Groundwater, and Aqueous Field QC Samples	Metals (Including Mercury)	SW-846 6010C, 7470A, 7471A, method specific criteria, DoD QSM criteria, and those listed in Worksheets #12, #15, #24, and #28 will be used. If not included in Worksheets #12, #15, #24, and #28, then the logic outlined in USEPA CLP "National Functional Guidelines for Inorganic Data Review" EPA-540-R-04-004 (USEPA, 2004) will be used to apply qualifiers to data.	Data Validation Specialist, Tetra Tech

SAP Worksheet #37 – Usability Assessment
(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment

The usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum. The results of these evaluations will be included in the project report. The characteristics will be evaluated for multiple concentration levels if the evaluator determines that this is necessary. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments of these data quality indicator characteristics:

Completeness

- For each matrix that was scheduled to be sampled, the Tetra Tech FOL acting on behalf of the Partnering Team will prepare a table listing planned samples/analyses to collected samples/analyses. If deviations from the scheduled sample collection or analyses are identified the Tetra Tech PM and risk assessor will determine whether the deviations compromise the ability to meet project objectives. If they do, the Tetra Tech PM will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

Precision

- The Tetra Tech Project Chemist acting on behalf of the Partnering Team will determine whether precision goals for field duplicates and laboratory duplicates were met. This will be accomplished by comparing duplicate results to precision goals identified in Worksheets #12 and #28. This will also include a comparison of field and laboratory precision with the expectation that field duplicate results will be no less precise than laboratory duplicate results. If the goals are not met, or data have been flagged as estimated (J qualifier), limitations on the use of the data will be described in the project report.

Accuracy

- The Tetra Tech Project Chemist acting on behalf of the Partnering Team will determine whether the accuracy/bias goals were met for project data. This will be accomplished by comparing percent recoveries of LCS, LCSD, MS, MSD, and surrogate compounds to accuracy goals identified in Worksheet #28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, MS, and LCS. If the goals are not met, limitations on the use of the data will be described in the project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the project report.

Representativeness

- A project scientist identified by the Tetra Tech PM and acting on behalf of the Partnering Team will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and processed for analysis in accordance with the SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report will describe the representativeness of the data for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the project scientist indicates that a quantitative analysis is required.

Comparability

- The Tetra Tech Project Chemist acting on behalf of the Partnering Team will determine whether the data generated under this project are sufficiently comparable to historical site data generated by different methods and for samples collected using different procedures and under different site conditions. This will be accomplished by comparing overall precision and bias

among data sets for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the Tetra Tech Project Chemist indicates that such quantitative analysis is required.

Sensitivity

- The Tetra Tech Project Chemist acting on behalf of the Partnering Team will determine whether project sensitivity goals listed in Worksheet #15 are achieved. The overall sensitivity and quantitation limits from multiple data sets for each matrix and analysis will be compared. If sensitivity goals are not achieved, the limitations on the data will be described. The Tetra Tech Project Chemist will enlist the help of the project risk assessor to evaluate deviations from planned sensitivity goals.

Project Assumptions and Data Outliers

- The Tetra Tech PM and designated team members will evaluate whether project assumptions are valid. This will typically be a qualitative evaluation but may be supported by quantitative evaluations. The type of evaluation depends on the assumption being tested.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

After completion of the data validation, the data and data quality will be reviewed to determine whether sufficient data of acceptable quality are available for decision making. In addition to the evaluations described above, a series of inspections and statistical analyses will be performed to estimate these characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples exhibiting non-detected results, number of samples exhibiting positive results, and the proportion of samples with detected and non-detected results. The Project Team members identified by the Tetra Tech PM will assess whether the data collectively support the attainment of project objectives. They will consider whether any missing or rejected data have compromised the ability to make decisions or to make the decisions with the desired level of confidence. The data will be evaluated to determine whether missing or rejected data can be compensated by other data. Although rejected data will generally not be used, there may be reason to use them in a weight of evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales.

For statistical comparisons and mathematical manipulations, non-detected values will be represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate samples will be used to represent the concentration at a particular sampled location.

Identify the personnel responsible for performing the usability assessment:

The Tetra Tech PM, Project Chemist, FOL, and Project Scientist will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the Navy RPM, Tetra Tech PM, the USEPA RPM, and the FDEP RPM. If deficiencies affecting the attainment of project objectives are identified, the review will take place either in a face to face meeting or a teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The data will be presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). Written documentation will support the non-compliance estimated or rejected data results. The project report will identify and describe the data usability limitations and suggest re-sampling or other corrective actions, if necessary.

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APPENDIX A

SAMPLING EVENT REPORT

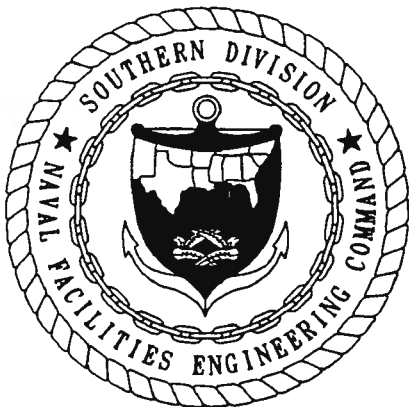


**SAMPLING EVENT REPORT
POTENTIAL SOURCE OF CONTAMINATION 38
TORPEDO REWORK FACILITY**

**NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA**

**UNIT IDENTIFICATION CODE: N00207
CONTRACT NO.: N62467-89-D-0317/040**

APRIL 1999



**SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
29418**

SAMPLING EVENT REPORT
POTENTIAL SOURCE OF CONTAMINATION 38
TORPEDO REWORK FACILITY

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Unit Identification Code: N00207

Contract No.: N62467-89-D-0317/040

Prepared by:

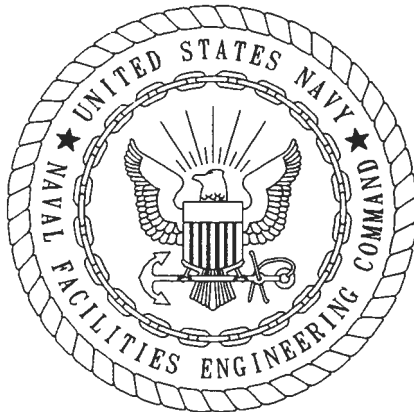
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Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29418

Dana Gaskins, Code 1857, Engineer-in-Charge

April 1999



CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, Harding Lawson Associates, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/040 are complete and accurate and comply with all requirements of this contract.

DATE: April 15, 1999

NAME AND TITLE OF CERTIFYING OFFICIAL: Phylissa Miller
Task Order Manager

NAME AND TITLE OF CERTIFYING OFFICIAL: Alex Olis, Ph.D., CPSS
Project Technical Lead

(DFAR 252.227-7036)

TABLE OF CONTENTS

Sampling Event Report
Potential Source of Contamination 38
Torpedo Rework Facility
Naval Air Station Jacksonville
Jacksonville, Florida

<u>Chapter</u>	<u>Title</u>	<u>Page No.</u>
1.0	INTRODUCTION	1-1
1.1	PURPOSE AND SCOPE	1-1
1.2	SITE DESCRIPTION	1-1
2.0	SAMPLING APPROACH AND FIELD CHANGES	2-1
3.0	QUALITY ASSURANCE AND QUALITY CONTROL	3-1
4.0	ANALYTICAL RESULTS	4-1
4.1	ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES	4-1
4.1.1	Volatile Organic Compounds	4-1
4.1.2	Semivolatile Organic Compounds	4-1
4.1.3	Pesticides and PCBs	4-1
4.1.4	Inorganic Parameters	4-1
4.2	ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES	4-1
4.2.1	Volatile Organic Compounds	4-1
4.2.2	Semivolatile Organic Compounds	4-1
4.2.3	Pesticides and PCBs	4-1
4.2.4	Inorganic Parameters	4-1
4.3	ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES	4-2
4.3.1	Volatile Organic Compounds	4-2
4.3.2	Semivolatile Organic Compounds	4-2
4.3.3	Pesticides and PCBs	4-2
4.3.4	Inorganic Parameters	4-2
4.4	ANALYTICAL RESULTS FOR SEDIMENT SAMPLES	4-2
4.4.1	Volatile Organic Compounds	4-2
4.4.2	Semivolatile Organic Compounds	4-2
4.4.3	Pesticides and PCBs	4-2
4.4.4	Inorganic Parameters	4-2
4.5	ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES	4-2
4.5.1	Volatile Organic Compounds	4-2
4.5.2	Semivolatile Organic Compounds	4-2
4.5.3	Pesticides and PCBs	4-2
4.5.4	Inorganic Parameters	4-3
5.0	RISK EVALUATION	5-1
6.0	REFERENCES	6-1

APPENDICES

Appendix A: Offsite Sample Tracking Log
Appendix B: Validated Analytical Results
Appendix C: Summary of Detections in Analytical Results

LIST OF FIGURES

Sampling Event Report
Potential Source of Contamination 38
Torpedo Rework Facility
Naval Air Station Jacksonville
Jacksonville, Florida

<u>Figure</u>	<u>Title</u>	<u>Page No.</u>
1-1	Location of PSC 38 at NAS Jacksonville	1-2
1-2	Sampling Locations at PSC 38, Torpedo Rework Facility	1-3

GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
B&R	Brown & Root Environmental
BEHP	bis(2-ethylhexyl)phthalate
bls	below land surface
DDE	dichlorodiphenyldichloroethene
EDS	Environmental Data Services
FDEP	Florida Department of Environmental Protection
FRE	focused risk evaluations
GGCs	groundwater guidance concentrations
IAS	Initial Assessment Study
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
µg/l	micrograms per liter
NAS	Naval Air Station
NFESC	Naval Facilities Engineering Service Center
OESO	Ordnance Environmental Support Office
PARCC	precision, accuracy, representativeness, completeness, and comparability
PSC	potential source of contamination
PCB	polychlorinated biphenyl
QA/QC	quality assurance and quality control
RRDS	Remedial Response Decision System
SDG	sample delivery group
SCG	soil cleanup goal
SSW	Site Screening Workplan
SVOC	semivolatile organic compound
TAL	target analyte list
TCL	target compound list
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

1.0 INTRODUCTION

Harding Lawson Associates, under contract to the Department of Navy (Contract No. N62467-89-D-0317, Task Order No. 040) is submitting this Sampling Event Report for Potential Source of Contamination (PSC) 38, the Torpedo Rework Facility, at Naval Air Station (NAS) Jacksonville, Jacksonville, Florida. PSC 38 is located within the restricted Magazine Area of NAS Jacksonville and encompasses Building 327, the Torpedo Rework Facility; Building 330, a storage building for paints and hazardous materials; and Building 367, the Bulk Waste Storage Area (Figures 1-1 and 1-2). Activities at the facility include the repair and cleaning of propulsion systems, the addition of Otto fuel to torpedoes, and inspection of torpedoes.

This Sampling Event Report summarizes the methods and the results of the field investigation and transmits the field and analytical data.

1.1 PURPOSE AND SCOPE. The purpose of the sampling event at PSC 38 was to gather sufficient information to support the next phase of the Remedial Response Decision System (RRDS) process (ABB Environmental Services, Inc. [ABB-ES], 1995). The scope of the sampling event, detailed in the Site Screening Workplan (SSW) (ABB-ES, 1997), at PSC 38 included the following:

- Collection of up to 17 soil samples. Up to 10 soil samples were to be collected from around the gravel sumps and the below-grade acid pit. Up to seven soil samples were to be collected from other suspect areas around the compound.
- Installation of two "micro" monitoring wells to collect groundwater samples downgradient of the facility.
- Collection of two surface water and sediment samples from the unlined drainage ditch along the east and south site borders.
- Laboratory analysis of the surface and subsurface soil, groundwater, surface water and sediment samples for U.S. Environmental Protection Agency (USEPA) target compound list (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL pesticides and polychlorinated biphenyls (PCBs), and target analyte list (TAL) inorganics.

Fieldwork for this sampling event was completed between April 22, 1997, and May 6, 1997, as well as on August 28, 1997.

1.2 SITE DESCRIPTION The Torpedo Rework Facility encompasses approximately 2.5 acres within the restricted Magazine Area in the central-west part of NAS Jacksonville. The facility is surrounded by an 8-foot-high fence and is accessible from Allegheny Road via a paved driveway. However, accessibility to the Magazine Area is limited to persons having a weapons area clearance.

There are three buildings within PSC 38: Building 327, the Torpedo Rework Facility; Building 367, the Bulk Waste Storage Area; and Building 330, a storage

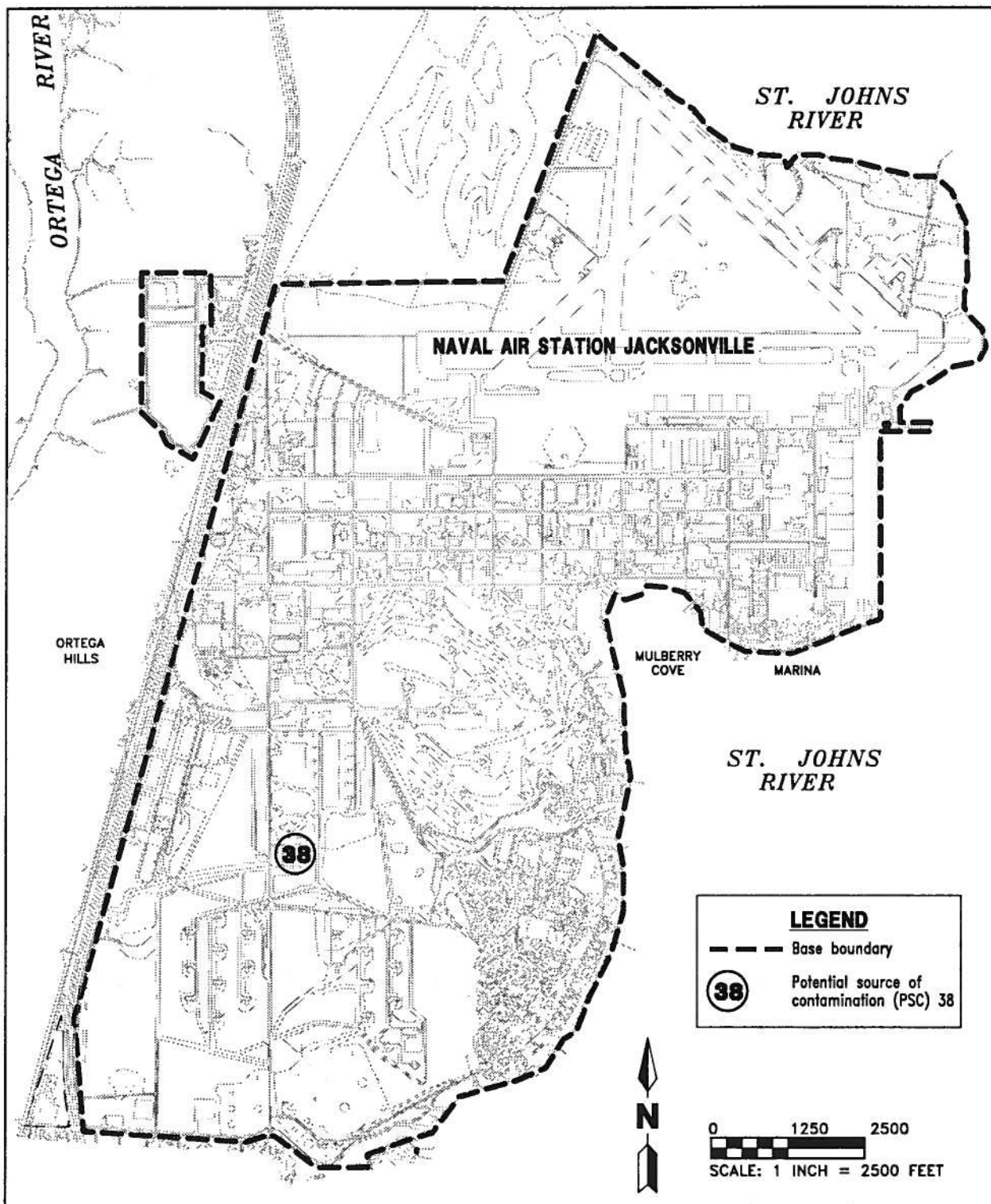


FIGURE 1-1
LOCATION OF PSC 38 AT
NAVAL AIR STATION JACKSONVILLE



SAMPLING EVENT REPORT
PSC 38

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

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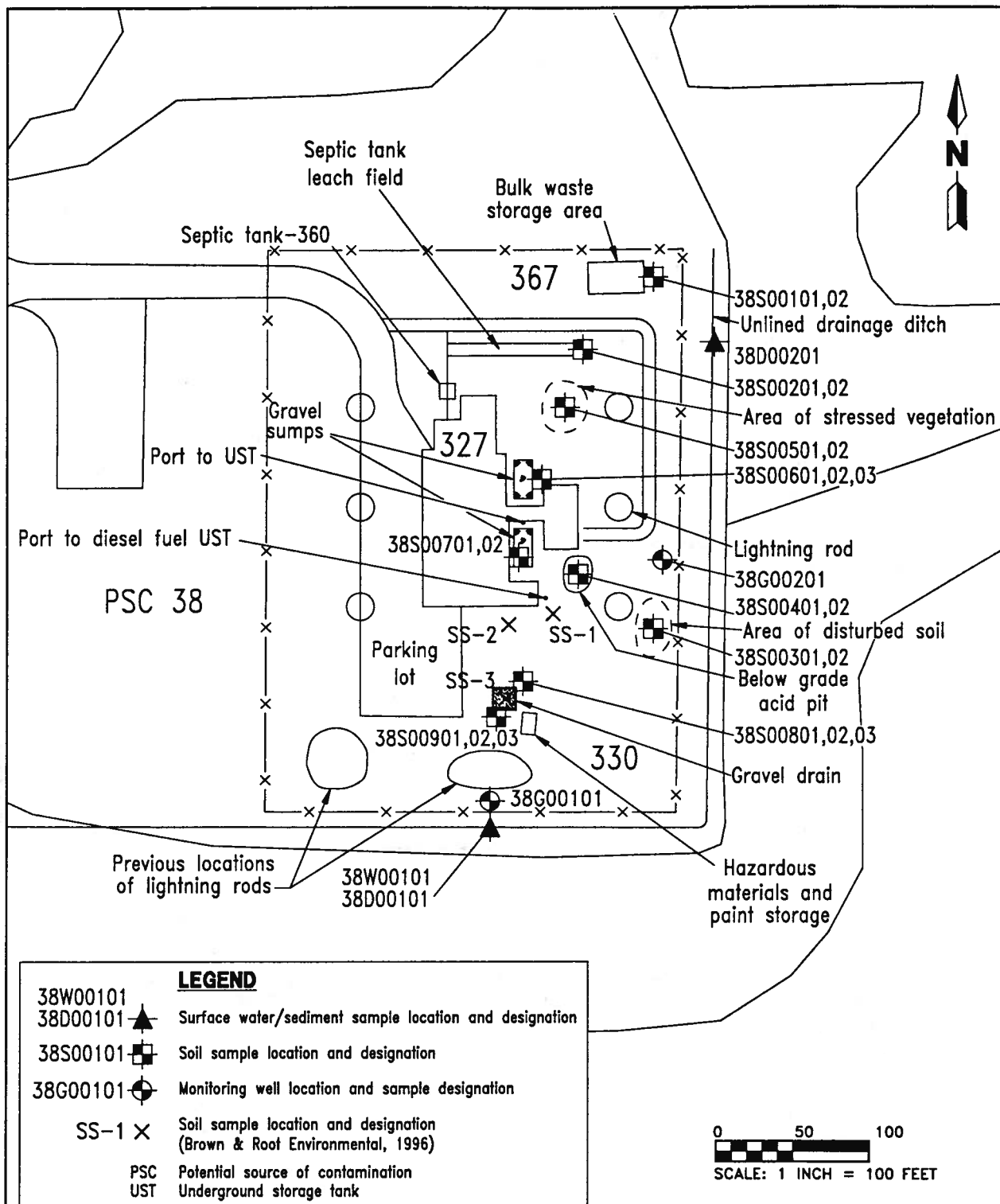


FIGURE 1-2
SAMPLING LOCATIONS
AT PSC 38
TORPEDO REWORK FACILITY



SAMPLING EVENT REPORT
PSC 38

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

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building for paint and hazardous materials. The area between the buildings and the high-security fence is covered with grass, with the exception of a 60-by-240-foot asphalt slab on the western side of Building 327 and a concrete walkway connecting Building 327, Building 367, and the paved driveway (Figure 1-2). The absence of grass in parts of the unpaved areas was noted during the PSC reconnaissance. Facility employees identified these areas as former locations of lightning rods.

In general, the PSC is flat and gently slopes to the south and east. An unlined drainage ditch parallels the eastern and southern sides of the PSC and flows westward under Allegheny Road. According to the topography and drainage map included in the Initial Assessment Study (IAS) report, PSC 38 is within the drainage basin of the Ortega River. The surface drainage eventually discharges to tributaries of the Ortega River, which is about 1 mile to the west.

The Torpedo Rework Facility was identified as a PSC during the IAS (Fred C. Hart Associates, Inc, 1983). During IAS interviews, personnel from the station and from the Ordnance Environmental Support Office (OESO) stated that the processes associated with reworking torpedoes generated approximately one 55-gallon drum of solid waste material (gloves and rags containing Otto fuel) at the facility per day. OESO personnel further indicated that drums containing wastes had always been disposed of off site. Because no wastes were disposed of on site and no releases of Otto fuel were documented, the IAS report did not recommend a confirmation study for PSC 38.

Geraghty & Miller, Inc., later discovered that unmonitored underground storage tanks (USTs) might be present at PSC 38 (Geraghty & Miller, Inc., 1991). In addition to these USTs, the report mentioned two gravel sumps, which may have received wastes, on the east side of Building 327. The locations of these sumps were not provided. Volume 1 of the Navy Installation Restoration Program recommended site screening for PSC 38 based on the past disposal practices at the gravel sumps (Geraghty and Miller, Inc., 1991). Geraghty and Miller, Inc.'s recommended site screening included sampling to determine if leakage from the gravel sumps had contaminated soil or groundwater in the vicinity of PSC 38. However, no sampling was conducted at that time.

During the PSC reconnaissance, ABB-ES observed fill ports for two USTs, confirming the presence of the two USTs noted previously by Geraghty & Miller, Inc. Mr. David Ford of the NAS Jacksonville Facilities Department confirmed that one tank was installed in 1958 and held 350 gallons of diesel fuel for an emergency generator (D. Ford, 1994). The second tank was a 1,000-gallon steel heating oil UST that was no longer in use. Diane Lancaster, NAS Jacksonville Installation Restoration Manager, subsequently reported that the steel UST is to be removed and replaced by a 1,500-gallon fiberglass UST. At that time the 350-gallon tank will also be removed. No records of tightness testing for either UST were available. ABB-ES observed dead grass around the fill port of the diesel fuel UST during the PSC reconnaissance, which suggests that diesel fuel may have spilled or overflowed.

During the records search in April 1994, ABB-ES found several maps showing a below-grade acid pit on the east side of Building 327. This pit is believed to have functioned as a disposal area for lead battery acid; however, its presence has not been confirmed. Septic tank No. 360 was also identified on a facility utility map. This tank was connected to sanitary facilities inside the building.

ABB-ES also observed a 3-by-6-foot concrete-bermed gravel drain on the west side of Building 330. Facility employees did not know its function and could not confirm it as a drain. No evidence of contamination, such as stained soil, odor, or stressed vegetation, was observed around the gravel drain.

In February 1996, Brown & Root Environmental (B&R) collected three surface soil samples for TCL and TAL analyses. The three sample locations (Figure 1-2) were selected in areas of suspected contamination: (1) within stained soil and stressed vegetation near the diesel fuel port; (2) within the area of sparse, vegetation at the southeast corner of Building 327; and (3) near the gravel drain adjacent to the doorway of Building 330 (B&R, 1996).

No organic chemicals were detected above Florida Department of Environmental Protection (FDEP) Soil Cleanup Goals (SCGs) (FDEP, 1995). However, several metals were detected in each sample. Of particular interest, the concentrations of antimony, arsenic, beryllium, cadmium, chromium, lead, and zinc exceeded their respective SCGs for residential areas.

2.0 SAMPLING APPROACH AND FIELD CHANGES

The work described herein was performed as presented in Section 4.11 of the SSW (ABB-ES, 1997). Exceptions to the proposed methods are described in this section.

Four additional soil samples were added to the 17 proposed samples in the SSW to investigate an area of fill near the eastern fence line and an area of stressed vegetation east of the bulk waste storage area (Figure 1-2). Five samples were collected from the gravel sump areas on the east side of Building 327 and six soil samples were collected from around the gravel drain near the hazardous materials and paint storage building (Building 330). Also, two samples were collected from near the area of the former below grade acid pit and two samples each were collected from near the bulk waste storage area (Building 367) and drainage field from septic tank No. 360. In addition, based on visually identified sparse or stressed vegetative cover, two samples each were collected from two additional suspect areas. A sample tracking log that includes sample and sample delivery group (SDG) identifiers, relevant dates, sample depths, and parameters analyzed is included in Appendix A.

One surface water and two sediment samples were collected from the unlined drainage ditch that parallels the eastern and southern side of the PSC. Surface water was present only at one of the sediment sample locations. Two "micro" monitoring wells were installed downgradient of the suspected source areas. Monitoring well MW001 was set at 13 feet below land surface (bls) with 9 feet of screen and MW002 was set at 12 feet bls with 9 feet of screen (Figure 1-2).

The soil, surface water, sediment, and groundwater samples collected for laboratory analysis were sent by overnight carrier to the subcontract laboratory, Compuchem Environmental Corporation, Cary, North Carolina. The samples were analyzed for TCL VOCs, SVOCs, pesticides and PCBs, and TAL inorganics. Following the laboratory analysis all data were validated in accordance with the Naval Facilities Engineering Service Center (NFESC) Level D protocol. The validated analytical results are included in Appendix B. A summary of the detections in the soil and groundwater analytical results is presented in Appendix C.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL

Field samples and associated quality assurance and quality control (QA/QC) samples were collected and analyzed according to USEPA and NFESC requirements. The analytical data packages, submitted by SDGs were independently validated by a subcontract data validation company, Environmental Data Services (EDS) (Concord, New Hampshire), in accordance with validation requirements contained in NFESC document Navy Installation Restoration Laboratory Quality Assurance Guide, February 1996. Other documents utilized in the data validation and review include the USEPA *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 1994a) and the USEPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA, 1994b).

A detailed QA/QC evaluation may be found in the EDS report (EDS, 1997), which summarizes the results of the data quality assessment according to the precision, accuracy, representativeness, completeness and comparability (PARCC) parameters for the entire site screening activity. The EDS report was issued as a separate document in Appendix B of the SSW. The generated analytical data were found to be acceptable according to the PARCC criteria, with less than 5 percent of the data requiring qualification (primarily estimated "J" qualifier).

4.0 ANALYTICAL RESULTS

4.1 ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES Eighteen surface soil samples were collected from nine locations at PSC 38. At each location a sample was collected from 0 to 1 foot and from 1 to 2 feet bls. The complete validated analytical data set are included in Appendix B. Appendix C presents a summary of the parameters detected in surface soil samples.

4.1.1 Volatile Organic Compounds No site-related VOCs were detected in the surface soil samples. Low levels of acetone and methylene chloride, indicative of lab or field contamination, were detected.

4.1.2 Semivolatile Organic Compounds Six SVOCs were detected in the surface soil samples analyzed, including 2,4-dimethylphenol, 2-methylnaphthalene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate (BEHP), and naphthalene. Only BEHP was detected in more than one sample.

4.1.3 Pesticides and Polychlorinated Biphenyls Nineteen pesticide and PCB compounds were identified in surface soil samples analyzed. All were detected at levels consistent with basewide background activities including the normal application of pesticides for insect control.

4.1.4 Inorganic Parameters Nineteen inorganic parameters were identified in the surface soil samples analyzed. Lead was detected at 2,350 milligrams per kilogram (mg/kg) in sample 38S00601.

4.2 ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES. Soil samples were collected from three locations at 2 to 3 feet bls. The validated analytical data are included in Appendix B. Appendix C presents a summary of the parameters detected in the subsurface soil samples.

4.2.1 Volatile Organic Compounds Ethylbenzene, toluene, and xylene were the only site-related VOCs detected at PSC 38. Each was detected at low levels in only one sample (S00603), which was collected directly east of one of the gravel sumps.

4.2.2 Semivolatile Organic Compounds Three SVOCs (2-methylnaphthalene, BEHP, and naphthalene) were detected in the same sample as the VOCs. BEHP was also detected at low levels in sample S00803, which is directly northeast of the gravel drain.

4.2.3 Pesticides and Polychlorinated Biphenyls Several pesticides were detected in the three subsurface soil samples. All were detected at levels consistent with basewide application of pesticides for pest control.

4.2.4 Inorganic Parameters Thirteen inorganic parameters were detected in subsurface soil. Most were at levels consistent with basewide background activities. In sample S00603, aluminum, calcium, iron, lead, magnesium, and zinc were detected at elevated levels.

4.3 ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES. The validated analytical data are included in Appendix B. Appendix C presents a summary of the parameters detected in surface water sample 38W00101.

4.3.1 Volatile Organic Compounds No VOCs were detected in the surface water sample analyzed.

4.3.2 Semivolatile Organic Compounds One SVOC, di-n-butylphthalate, was detected at 3 micrograms per liter ($\mu\text{g}/\ell$). This detection appears to be a laboratory and/or sampling artifact

4.3.3 Pesticides and Polychlorinated Biphenyls No pesticide or PCB compounds were detected in the surface water sample analyzed.

4.3.4 Inorganic Parameters Thirteen inorganic parameters were detected in the surface water sample analyzed. Only iron, at a concentration of 2,690 $\mu\text{g}/\ell$, was detected at elevated levels.

4.4 ANALYTICAL RESULTS FOR SEDIMENT SAMPLES. The validated analytical data are included in Appendix B. Appendix C presents a summary of the parameters detected in sediment samples.

4.4.1 Volatile Organic Compounds No VOCs were detected in the sediment samples analyzed.

4.4.2 Semivolatile Organic Compounds No SVOCs were detected in the sediment samples analyzed.

4.4.3 Pesticides and Polychlorinated Biphenyls Three pesticides were detected at low concentrations in the sediment samples analyzed. 4,4'-dichlorodiphenyldichloroethene (DDE) and heptachlor were detected in both samples, and endrin aldehyde was detected in only one sample. The detected levels were consistent with basewide application of pesticides for insect control.

4.4.4 Inorganic Parameters Nineteen inorganic parameters were detected in the sediment samples analyzed. All were detected at low levels consistent with basewide background activities.

4.5 ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES. The validated analytical data are included in Appendix B. Appendix C presents a summary of the parameters detected in the groundwater samples collected at PSC 38.

4.5.1 Volatile Organic Compounds VOCs were detected in groundwater sample 38G00201, which is on the east side of PSC 38. Of the four VOCs detected, three were at significant levels (1,2-dichloroethene [total] at 73 $\mu\text{g}/\ell$, trichloroethene at 24 $\mu\text{g}/\ell$, and vinyl chloride at 57 $\mu\text{g}/\ell$).

4.5.2 Semivolatile Organic Compounds No SVOCs were detected in the groundwater samples analyzed.

4.5.3 Pesticides and Polychlorinated Biphenyls No pesticide or PCB compounds were detected in the groundwater samples analyzed.

4.5.4 Inorganic Parameters Fourteen inorganic parameters were detected in groundwater samples analyzed. However, none were detected at levels that suggested contamination from on-site activities.

5.0 RISK EVALUATION

The purpose of performing focused risk evaluations (FRE) as part of the site screening evaluation is to assist in determining whether or not the existing risk at a PSC (1) supports a no further action decision, (2) indicates the need for an interim remedial action, or (3) requires additional investigation to make a decision. The documentation of the decision for PSC 38 may be found in the RRDS document for PSC 38 (ABB-ES, 1995). The FRE were not intended to characterize "baseline" risk at the PSC, but rather were used as a decision making tool.

It was not necessary to conduct an FRE to support the decision to perform an interim remedial action at one of the gravel sumps and to collect additional groundwater data because levels of certain contaminants significantly exceeded guidance and regulatory levels. One of the surface soil samples (sample 38S00601, which was immediately adjacent to one of the gravel sumps) contained lead at 2,350 mg/kg, which significantly exceeds the FDEP residential SCG of 500 mg/kg and the industrial SCG of 1,000 mg/kg (FDEP, 1995). The groundwater sample taken from the eastern side of PSC 38 contained trichloroethene, and its breakdown products 1,2-dichloroethene and vinyl chloride, at levels above the primary groundwater standards (the FDEP groundwater guidance concentrations [GGCs] and the Federal maximum contaminant levels [MCLs]). Trichloroethene was detected at 24 $\mu\text{g}/\ell$ compared to 3 $\mu\text{g}/\ell$ (GGC) and 5 $\mu\text{g}/\ell$ (MCL); vinyl chloride was detected at 57 $\mu\text{g}/\ell$ compared to 1 $\mu\text{g}/\ell$ (GGC) and 2 $\mu\text{g}/\ell$ (MCL); and dichloroethene was detected at 73 $\mu\text{g}/\ell$ compared to 70 $\mu\text{g}/\ell$ (GGC and MCL).

6.0 REFERENCES

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APPENDIX A
OFF-SITE SAMPLE TRACKING LOG

Appendix A

PSC 38 OFFSITE SAMPLE TRACKING LOG SITE SCREENING, NAS JACKSONVILLE

SDG	SAMPLE ID	SAMP DATE	UDEPTH (ft bls)	LDEPTH (ft bls)	MATRIX	TAL MET	TCL VOC	TCL SVOC	TCL PESTPCB	DRFL	TAT	DSTV	DRFV
0019S	38D00101	8/28/97	NA	NA	sediment	X	X	X	X	10/7/97	40	10/7/97	10/21/97
0019S	38D00201	8/28/97	NA	NA	sediment	X	X	X	X	10/7/97	40	10/7/97	10/21/97
00007	38G00101	4/22/97	4	13	groundwater	X	X	X	X	6/2/97	31	6/20/97	7/18/97
00007	38G00201	4/24/97	3	12	groundwater	X	X	X	X	6/2/97	31	6/20/97	7/18/97
00008	38S00101	5/5/97	0	1	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00102	5/5/97	1	2	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00201	5/5/97	0	1	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00202	5/5/97	1	2	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00301	5/5/97	0	1	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00302	5/5/97	1	2	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00401	5/5/97	0	1	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00402	5/5/97	1	2	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00501	5/5/97	0	1	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00502	5/5/97	1	2	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00601	5/5/97	0	1	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00008	38S00602	5/5/97	1	2	soil	X	X	X	X	6/6/97	32	6/20/97	7/18/97
00009	38S00603	5/6/97	2	3	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
00009	38S00701	5/5/97	0	1	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
00009	38S00702	5/5/97	1	2	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
00009	38S00801	5/6/97	0	1	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
00009	38S00802	5/6/97	1	2	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
00009	38S00803	5/6/97	2	3	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
00009	38S00901	5/6/97	0	1	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
00009	38S00902	5/6/97	1	2	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
00009	38S00903	5/6/97	2	3	soil	X	X	X	X	6/12/97	30	6/20/97	7/21/97
0019W	38W00101	8/28/97	NA	NA	surface water	X	X	X	X	10/7/97	40	10/7/97	10/21/97

Appendix A

PSC 38
OFFSITE SAMPLE TRACKING LOG
SITE SCREENING, NAS JACKSONVILLE

NOTES:

SDG	Sample Delivery Group (defined group of 20 samples or less collected not more than 14 days of each other).
SAMPLE ID	Sample Identifier
SAMP DATE	Date of Sample Collection
UDEPTH, LDEPTH	Depths, upper (UDEPTH) and lower (LDEPTH)
MATRIX	Media Sampled
TAL MET	Target Analyte List Metals
TCL VOC	Target Compound List Volatile Organics
TCL SVOC	Target Compound List Semivolatile Organics
TCL PESTPCB	Target Compound List Pesticides and Polychlorinated Biphenyls
DRFL	Date Package Received from Laboratory
TAT	Turnaround Time (days)
DSTV	Date Package Sent to Validators
DRFV	Date Package Received from Validators

APPENDIX B

VALIDATED ANALYTICAL RESULTS

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00101	38S00102	38S00201	38S00202	38S00301	38S00302	38S00401	38S00402	38S00501	38S00502	38S00601
Sampling Date	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97
Volatile organics, ug/kg											
1,1,1-Trichloroethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1,2,2-Tetrachloroethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1,2-Trichloroethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1-Dichloroethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,1-Dichloroethene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,2-Dichloroethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,2-Dichloroethene (total)	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
1,2-Dichloropropane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
2-Butanone	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
2-Hexanone	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
4-Methyl-2-pentanone	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Acetone	15 J	56 J	220 J	160 J	98 J	74 J	50 J	49 J	12 U	12 U	11 U
Benzene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Bromodichloromethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Bromoform	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Bromomethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Carbon disulfide	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Carbon tetrachloride	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Chlorobenzene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Chloroethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Chloroform	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Chloromethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
cis-1,3-Dichloropropene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Dibromochloromethane	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Ethylbenzene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Methylene chloride	1 J	1 J	2 J	2 J	2 J	2 J	2 J	12 U	12 U	12 U	2 J
Styrene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Tetrachloroethene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Toluene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
trans-1,3-Dichloropropene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Trichloroethene	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Vinyl chloride	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Xylene (total)	12 U	12 U	13 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U	11 U
Semivolatile organics, ug/kg											
1,2,4-Trichlorobenzene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00101	38S00102	38S00201	38S00202	38S00301	38S00302	38S00401	38S00402	38S00501	38S00502	38S00601
Sampling Date	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97
1,2-Dichlorobenzene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
1,3-Dichlorobenzene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
1,4-Dichlorobenzene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2,2'-oxybis(1-Chloropropane)	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2,4,5-Trichlorophenol	1000 U	1000 U	1100 U	1000 U	910 U	990 U	1000 U	980 U	1000 U	990 U	4600 U
2,4,6-Trichlorophenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2,4-Dichlorophenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2,4-Dimethylphenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2,4-Dinitrophenol	1000 U	1000 U	1100 U	1000 U	910 U	990 U	1000 U	980 U	1000 U	990 U	4600 U
2,4-Dinitrotoluene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2,6-Dinitrotoluene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2-Chloronaphthalene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2-Chlorophenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2-Methylnaphthalene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2-Methylphenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
2-Nitroaniline	1000 U	1000 U	1100 U	1000 U	910 U	990 U	1000 U	980 U	1000 U	990 U	4600 U
2-Nitrophenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
3,3'-Dichlorobenzidine	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
3-Nitroaniline	1000 U	1000 U	1100 U	1000 U	910 U	990 U	1000 U	980 U	1000 U	990 U	4600 U
4,6-Dinitro-2-methylphenol	1000 U	1000 U	1100 U	1000 U	910 U	990 U	1000 U	980 U	1000 U	990 U	4600 U
4-Bromophenyl-phenylether	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
4-Chloro-3-methylphenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
4-Chloroaniline	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
4-Chlorophenyl-phenylether	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
4-Methylphenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
4-Nitroaniline	1000 U	1000 U	1100 U	1000 U	910 U	990 U	1000 U	980 U	1000 U	990 U	4600 U
4-Nitrophenol	1000 U	1000 U	1100 U	1000 U	910 U	990 U	1000 U	980 U	1000 U	990 U	4600 U
Acenaphthene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Acenaphthylene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Anthracene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Benzo(a)anthracene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Benzo(a)pyrene	400 U	400 U	420 U	410 U	360 U		400 U	390 U	410 U	400 U	1800 U
Benzo(b)fluoranthene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Benzo(g,h,i)perylene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Benzo(k)fluoranthene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
bis(2-Chloroethoxy)methane	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00101	38S00102	38S00201	38S00202	38S00301	38S00302	38S00401	38S00402	38S00501	38S00502	38S00601
Sampling Date	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97
bis(2-Chloroethyl)ether	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
bis(2-Ethylhexyl)phthalate	400 U	400 U	80 J	49 J	51 J	110 J	52 J	54 J	66 J	400 U	1700 J
Butylbenzylphthalate	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Carbazole	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Chrysene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Di-n-butylphthalate	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Di-n-octylphthalate	400 UJ	400 UJ	420 UJ	410 UJ	360 UJ	390 UJ	400 UJ	390 UJ	410 UJ	400 UJ	1800 U
Dibenz(a,h)anthracene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Dibenzofuran	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Diethylphthalate	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Dimethylphthalate	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Fluoranthene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Fluorene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Hexachlorobenzene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Hexachlorobutadiene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Hexachlorocyclopentadiene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Hexachloroethane	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Indeno(1,2,3-cd)pyrene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Isophorone	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
N-Nitroso-di-n-propylamine	400 UJ	400 UJ	420 UJ	410 UJ	360 UJ	390 UJ	400 UJ	390 UJ	410 UJ	400 UJ	1800 U
N-Nitrosodiphenylamine (1)	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Naphthalene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Nitrobenzene	400 UJ	400 UJ	420 UJ	410 UJ	360 UJ	390 UJ	400 UJ	390 UJ	410 UJ	400 UJ	1800 U
Pentachlorophenol	1000 U	1000 U	1100 U	1000 U	910 U	990 U	1000 U	980 U	1000 U	990 U	4600 U
Phenanthrene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Phenol	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Pyrene	400 U	400 U	420 U	410 U	360 U	390 U	400 U	390 U	410 U	400 U	1800 U
Pesticides/PCBs, ug/kg											
4,4'-DDD	4 UJ	4 UJ	6.7 U	4.1 UJ	3.6 U	3.9 U	4 UJ	3.9 U	4.1 UJ	4 UJ	4 UJ
4,4'-DDE	0.34 J	4 U	6.4	0.37 J	0.22 J	0.78 J	4 U	1.8 J	2 J	4 U	2.8 J
4,4'-DDT	4 UJ	4 UJ	4.3 U	4.1 U	3.6 UJ	3.9 UJ	4 UJ	3.9 UJ	5.4 U	4 UJ	9.5 UJ
Aldrin	2.1 U	2.1 U	2.2 U	2.1 U	1.8 U	0.2 J	2.1 U	2 U	2.1 U	2 U	1.2 J
alpha-BHC	2.1 U	2.1 U	2.2 U	2.1 U	1.8 U	2 U	0.09 J	2 U	2.1 U	2 U	1.9 U
alpha-Chlordane	0.26 J	0.64 J	0.38 J	0.26 J	0.15 J	5.3	6.6 J	7.9 J	0.2 J	2 U	4.9
Aroclor-1016	40 U	40 U	42 U	41 U	36 U	39 U	40 U	39 U	41 U	40 U	37 U
Aroclor-1221	81 U	82 U	86 U	83 U	73 U	79 U	82 U	80 U	83 U	81 U	75 U

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00101	38S00102	38S00201	38S00202	38S00301	38S00302	38S00401	38S00402	38S00501	38S00502	38S00601
Sampling Date	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97
Aroclor-1232	40 U	40 U	42 U	41 U	36 U	39 U	40 U	39 U	41 U	40 U	37 U
Aroclor-1242	40 U	40 U	42 U	41 U	36 U	39 U	40 U	62	41 U	40 U	37 U
Aroclor-1248	40 U	40 U	42 U	41 U	36 U	39 U	40 U	39 U	41 U	40 U	37 U
Aroclor-1254	40 U	40 U	42 U	41 U	36 U	39 U	40 U	39 U	41 U	40 U	37 U
Aroclor-1260	40 U	40 U	42 U	41 U	9.6 J	15 J	16 J	33 J	8.2 J	40 U	37 U
beta-BHC	2.1 U	2.1 U	2.2 U	2.1 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2 U	1.9 U
delta-BHC	2.1 U	2.1 U	2.2 U	2.1 U	1.8 U	2 U	2.1 U	2 U	0.13 J	2 U	1.9 U
Dieldrin	0.15 J	4 U	0.25 J	4.1 U	3.6 U	3.9 U	4 U	3.9 U	0.26 J	0.18 J	1.2 J
Endosulfan I	2.1 U	2.1 U	2.2 U	2.1 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2 U	1.9 U
Endosulfan II	4 U	4 U	4.2 U	4.1 U	3.6 U	3.9 U	4 U	3.9 U	4.1 U	4 U	5.5 J
Endosulfan sulfate	4 U	4 U	4.2 U	4.1 U	3.6 U	0.1 J	4 U	3.9 U	4.1 U	4 U	12 J
Endrin	4 U	4 U	4.2 U	4.1 U	3.6 U	0.2 J	4 U	0.38 J	4.1 U	4 U	0.41 J
Endrin aldehyde	4 U	4 U	4.2 U	4.1 U	3.6 U	3.9 U	0.4 J	3.9 U	4.1 U	4 U	4.5 J
Endrin ketone	4 U	4 U	0.42 J	4.1 U	3.6 U	3.9 U	4 U	3.9 U	0 J	4 U	1.5 J
gamma-BHC (Lindane)	2.1 U	2.1 U	2.2 U	2.1 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2 U	1.9 U
gamma-Chlordane	0.2 J	0.38 J	0.32 J	0.18 J	0.4 J	5.2	5.5 J	7 J	0.3 J	0.18 J	2
Heptachlor	2.1 U	2.1 U	2.2 U	2.1 U	1.8 U	2 U	2.1 U	2 U	2.1 U	2 U	0.11 J
Heptachlor epoxide	2.1 U	2.1 U	2.2 U	2.1 U	1.8 U	0.29 J	2.1 U	0.74 J	2.1 U	2 U	0.19 J
Methoxychlor	21 U	21 U	22 UJ	21 U	18 U	20 U	21 U	20 U	21 U	20 UJ	25 UJ
Toxaphene	210 U	210 U	220 U	210 U	180 U	200 U	210 U	200 U	210 U	200 U	190 U
Inorganics, mg/kg											
Aluminum	756 J	610 J	1010 J	1250 J	2140 J	528 J	959 J	1600 J	760 J	846 J	1260 J
Antimony	0.59 U	0.58 U	0.62 U	0.6 U	0.53 U	1.9 J	0.58 U	0.57 U	0.6 U	0.58 U	0.54 U
Arsenic	0.68 U	0.68 U	0.72 U	0.7 U	0.75 U	0.67 U	0.68 U	0.67 U	0.7 U	0.68 U	0.63 U
Barium	3.3 J	3.3 J	10.2 J	2.5 J	14.8 J	23.1 J	5 J	6.9 J	9.4 J	1.5 J	10 J
Beryllium	0.05 U	0.05 U	0.08 U	0.08 U	0.14 U	0.05 U	0.09 U	0.07 U	0.09 U	0.1 U	0.07 U
Cadmium	0.1 U	0.1 U	0.1 U	0.1 U	0.09 U	5.5 J	0.1 U	0.1 U	0.1 U	0.1 U	11 J
Calcium	295 J	222 J	2660	418 J	71600	1540	463 J	549 J	1050 J	257 J	814 J
Chromium	1.2 J	1 J	1.6 J	1.8 J	7.7 J	270 J	1.8 J	2.8 J	1.4 J	1 J	9 J
Cobalt	0.22 U	0.22 U	0.23 U	0.55 U	0.2 U	0.53 U	0.22 U	0.21 U	0.22 U	0.22 U	0.51 U
Copper	4.1 U	3.2 U	3.5 U	1.2 U	153 J	17.4 U	6 J	13.8 J	6 J	1.5 U	8.7 J
Iron	229 J	155 J	1190 J	518 J	3420 J	1500 J	1000 J	1860 J	1220 J	151 J	709 J
Lead	3.7 J	2.4 J	6.9 J	2.7 J	9.8 J	22.3 J	6.6 J	9.8 J	9.8 J	1.7 J	2350 J
Magnesium	36.1 J	26.5 J	66.5 J	30.9 J	490 J	35 J	45.4 J	54.7 J	43.1 J	22.2 U	77.8 J
Manganese	2 J	2.2 J	9.9 J	0.98 J	9.6 J	5 J	2.7 J	3.6 J	4.5 J	0.61 J	13.6 J
Mercury	0.06 UJ	0.06 UJ	0.06 UJ	0.06 UJ	0.05 UJ	0.08 J	0.06 UJ	0.06 UJ	0.06 UJ	0.06 UJ	0.06 J

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00101	38S00102	38S00201	38S00202	38S00301	38S00302	38S00401	38S00402	38S00501	38S00502	38S00601
Sampling Date	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97	5/5/97
Nickel	0.32 UJ	0.32 UJ	0.64 J	0.34 J	0.75	1.8 J	0.54 J	0.63 J	0.65 J	0.44 J	1.2 J
Potassium	37.5 U	46.9 U	56.3 U	37.7 U	81.7 J	38 U	59.9 U	57.1 U	37.1 U	36.1 U	79.4 J
Selenium	1.1 U	1 U	1.1 U	1.1 U	0.94 U	1 U	1 U	1 U	1.1 U	1 U	0.96 U
Silver	0.17 U	0.17 U	0.18 U	0.17 U	0.17 J	6.3	0.17 U	0.17 U	0.17 U	0.17 U	0.45 U
Sodium	365 U	400 U	389 U	377 U	341 U	374 U	398 U	390 U	381 U	357 U	384 U
Thallium	1.3 U	1.3 U	1.4 U	1.4 U	1.2 U	1.3 U	1.3 U	1.3 U	1.4 U	1.3 U	1.2 U
Vanadium	1.5 J	1.2 J	2.9 J	4 J	5.5 J	1.8 J	2.4 J	3.1 J	2.2 J	1.9 J	2.8 J
Zinc	14 J	5.8 J	7.1 J	3.4 J	9.5 J	16.4 J	11.8 J	77.6 J	8.8 J	3.4 J	105 J

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00602	38S00701	38S00702	38S00801	38S00802	38S00901	38S00902
Sampling Date	5/5/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97
Volatile organics, ug/kg							
1,1,1-Trichloroethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
1,1,2,2-Tetrachloroethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
1,1,2-Trichloroethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
1,1-Dichloroethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
1,1-Dichloroethene	11 U	11 U	12 U	12 U	12 U	12 U	13 U
1,2-Dichloroethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
1,2-Dichloroethene (total)	11 U	11 U	12 U	12 U	12 U	12 U	13 U
1,2-Dichloropropane	11 UJ	11 UJ	12 UJ	12 UJ	12 U	12 U	13 U
2-Butanone	11 UJ	11 UJ	12 UJ	12 UJ	12 UJ	12 UJ	13 UJ
2-Hexanone	11 UJ	11 UJ	12 UJ	12 UJ	12 UJ	12 UJ	13 UJ
4-Methyl-2-pentanone	11 UJ	11 UJ	12 UJ	12 UJ	12 U	12 U	13 U
Acetone	11 UJ	11 UJ	12 UJ	12 UJ	12 UJ	12 UJ	13 UJ
Benzene	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Bromodichloromethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Bromoform	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Bromomethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Carbon disulfide	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Carbon tetrachloride	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Chlorobenzene	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Chloroethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Chloroform	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Chloromethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
cis-1,3-Dichloropropene	11 UJ	11 UJ	12 UJ	12 UJ	12 U	12 U	13 U
Dibromochloromethane	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Ethylbenzene	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Methylene chloride	2 J	2 J	1 J	2 J	2 J	2 J	3 J
Styrene	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Tetrachloroethene	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Toluene	11 U	11 U	12 U	12 U	12 U	12 U	13 U
trans-1,3-Dichloropropene	11 UJ	11 UJ	12 UJ	12 UJ	12 U	12 U	13 U
Trichloroethene	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Vinyl chloride	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Xylene (total)	11 U	11 U	12 U	12 U	12 U	12 U	13 U
Semivolatile organics, ug/kg							
1,2,4-Trichlorobenzene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00602	38S00701	38S00702	38S00801	38S00802	38S00901	38S00902
Sampling Date	5/5/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97
1,2-Dichlorobenzene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
1,3-Dichlorobenzene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
1,4-Dichlorobenzene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2,2'-oxybis(1-Chloropropane)	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2,4,5-Trichlorophenol	920 U	940 U	1000 UJ	1000 U	980 U	970 U	1000 U
2,4,6-Trichlorophenol	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2,4-Dichlorophenol	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2,4-Dimethylphenol	300 J	370 U	400 UJ	410 U	390 U	380 U	420 U
2,4-Dinitrophenol	920 U	940 U	1000 UJ	1000 U	980 U	970 U	1000 U
2,4-Dinitrotoluene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2,6-Dinitrotoluene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2-Chloronaphthalene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2-Chlorophenol	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2-Methylnaphthalene	40 J	370 U	400 UJ	410 U	390 U	380 U	420 U
2-Methylphenol	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
2-Nitroaniline	920 U	940 U	1000 UJ	1000 U	980 U	970 U	1000 U
2-Nitrophenol	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
3,3'-Dichlorobenzidine	360 UJ	370 U	400 UJ	410 U	390 U	380 U	420 U
3-Nitroaniline	920 U	940 U	1000 UJ	1000 U	980 U	970 U	1000 U
4,6-Dinitro-2-methylphenol	920 U	940 U	1000 UJ	1000 U	980 U	970 U	1000 U
4-Bromophenyl-phenylether	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
4-Chloro-3-methylphenol	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
4-Chloroaniline	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
4-Chlorophenyl-phenylether	360 U	370 U	400 UJ	410 U	390 UJ	380 UJ	420 UJ
4-Methylphenol	360 UJ	370 U	400 UJ	410 U	390 U	380 U	420 U
4-Nitroaniline	920 U	940 U	1000 UJ	1000 U	980 U	970 U	1000 U
4-Nitrophenol	920 U	940 U	1000 UJ	1000 U	980 UJ	970 UJ	1000 UJ
Acenaphthene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Acenaphthylene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Anthracene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Benzo(a)anthracene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Benzo(a)pyrene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Benzo(b)fluoranthene	360 U	64 J	400 UJ	410 U	390 U	380 U	420 U
Benzo(g,h,i)perylene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Benzo(k)fluoranthene	360 U	56 J	400 UJ	410 U	390 U	380 U	420 U
bis(2-Chloroethoxy)methane	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00602	38S00701	38S00702	38S00801	38S00802	38S00901	38S00902
Sampling Date	5/5/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97
bis(2-Chloroethyl)ether	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
bis(2-Ethylhexyl)phthalate	1100	370 U	400 UJ	48 J	390 U	100 J	420 U
Butylbenzylphthalate	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Carbazole	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Chrysene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Di-n-butylphthalate	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Di-n-octylphthalate	360 UJ	370 U	400 UJ	410 U	390 U	380 U	420 U
Dibenz(a,h)anthracene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Dibenzofuran	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Diethylphthalate	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Dimethylphthalate	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Fluoranthene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Fluorene	360 U	370 U	400 UJ	410 U	390 UJ	380 UJ	420 UJ
Hexachlorobenzene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Hexachlorobutadiene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Hexachlorocyclopentadiene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Hexachloroethane	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Indeno(1,2,3-cd)pyrene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Isophorone	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
N-Nitroso-di-n-propylamine	360 UJ	370 U	400 UJ	410 U	390 UJ	380 UJ	420 UJ
N-Nitrosodiphenylamine (1)	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Naphthalene	80 J	370 U	400 UJ	410 U	390 U	380 U	420 U
Nitrobenzene	360 UJ	370 U	400 UJ	410 U	390 U	380 U	420 U
Pentachlorophenol	920 U	940 U	1000 UJ	1000 U	980 U	970 U	1000 U
Phenanthrene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Phenol	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Pyrene	360 U	370 U	400 UJ	410 U	390 U	380 U	420 U
Pesticides/PCBs, ug/kg							
4,4'-DDD	3.7 UJ	5.7 UJ	4 UJ	4 U	3.9 UJ	3.8 U	4.2 UJ
4,4'-DDE	1.8 J	3.8 U	4 U	2.6 J	2.1 J	2 J	1.6 J
4,4'-DDT	3.7 UJ	3.8 UJ	5.3 UJ	4 U	3.9 UJ	7.7 J	4.2 UJ
Aldrin	0.41 J	1.9 U	2.1 U	2.1 U	2 U	2 U	2.2 U
alpha-BHC	1.9 U	1.9 U	2.1 U	2.1 U	2 U	2 U	2.2 U
alpha-Chlordane	18 J	1.9 U	2.1 U	4.2 J	0.7 J	2 UJ	0.91 J
Aroclor-1016	37 U	38 U	40 U	40 U	39 U	38 U	42 U
Aroclor-1221	75 U	76 U	81 U	82 U	79 U	78 U	86 U

Appendix B-1

Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00602	38S00701	38S00702	38S00801	38S00802	38S00901	38S00902
Sampling Date	5/5/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97
Aroclor-1232	37 U	38 U	40 U	40 U	39 U	38 U	42 U
Aroclor-1242	37 U	71	40 U	40 U	39 U	38 U	42 U
Aroclor-1248	37 U	38 U	40 U	40 U	39 U	38 U	42 U
Aroclor-1254	37 U	38 U	40 U	40 U	39 U	38 U	42 U
Aroclor-1260	27 J	58	40 U	66	48	180	42 U
beta-BHC	1.9 U	1.9 U	2.1 U	2.1 U	2 U	2 U	2.2 U
delta-BHC	1.9 U	1.9 U	2.1 U	2.1 U	2 U	2 U	2.2 U
Dieldrin	3.7 U	3.8 U	4 U	4 U	0.44 J	0.85 J	4.2 U
Endosulfan I	1.9 U	1.9 U	2.1 U	2.1 U	0.09 J	2 U	2.2 U
Endosulfan II	3.7 U	3.8 U	4 U	4 U	1.6 J	3.8 U	0.58 J
Endosulfan sulfate	1 J	3.8 U	4 U	4 U	3.9 U	1.1 J	4.2 U
Endrin	0.36 J	3.8 U	4 U	4 U	4.2	3.8 U	4.2 U
Endrin aldehyde	1 J	3.8 U	4 U	4 U	0.58 J	3 J	4.2 U
Endrin ketone	3.7 U	3.8 U	4 U	4 U	3.9 U	3.8 U	0.8 J
gamma-BHC (Lindane)	0.26 J	1.9 U	2.1 U	2.1 U	2 U	2 U	2.2 U
gamma-Chlordane	22 J	1.2 J	0.22 J	4.1	0.65 J	0.89 J	0.42 J
Heptachlor	1.9 U	1.9 U	2.1 U	2.1 U	2 U	2 U	2.2 U
Heptachlor epoxide	0.81 J	1.9 U	2.1 U	2.1 U	2 U	2 U	2.2 U
Methoxychlor	19 UJ	19 U	21 U	21 U	20 U	20 UJ	22 UJ
Toxaphene	190 U	190 U	210 U	210 U	200 U	200 U	220 U
Inorganics, mg/kg							
Aluminum	1270 J	1030 J	1650 J	714 J	612 J	696 J	966 J
Antimony	0.54 U	0.55 U	0.59 U	0.59 U	0.57 U	0.57 U	0.62 U
Arsenic	0.63 U	0.65 U	0.69 U	0.69 U	0.67 U	0.66 U	0.72 U
Barium	6.4 J	14.8 J	10.9 J	5.4 J	2.3 J	6.9 J	3.5 J
Beryllium	0.13 U	0.14 U	0.07 U	0.06 U	0.05 U	0.05 U	0.05 U
Cadmium	1.2 J	0.79 J	0.1 U	0.11 J	0.1 U	0.09 U	0.1 U
Calcium	602 J	1110 J	642 J	422 J	134 J	395 J	708 J
Chromium	10.3 J	5	2.5	27	5.2	8.5	2.4 J
Cobalt	0.31 U	0.4 J	0.22 U	0.42 J	0.22 U	0.26 J	0.23 U
Copper	3.6 J	123	8.5	5.1 J	1.7 J	12	3.7 J
Iron	626 J	2180	1740	394	421	317	190
Lead	290 J	94.3	6.3	21.3	3.5	36.6	3.9
Magnesium	47.4 J	236 J	63 J	27.3 J	15.5 U	47.2 J	36.5 J
Manganese	6.5 J	31.2	4.9	2.5 J	1.6 J	4.8	1.7 J
Mercury	0.06 UJ	0.07 UJ	0.07 UJ	0.07 UJ	0.07 U	0.07 UJ	0.06 UJ

Appendix B-1

**Validated Analytical Results
Surface Soil - TAL Metals and TCL Organics
PSC 38**

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00602	38S00701	38S00702	38S00801	38S00802	38S00901	38S00902
Sampling Date	5/5/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97	5/6/97
Nickel	0.66 J	2.1 J	0.69 J	0.36 J	0.31 U	0.34 J	0.33 U
Potassium	59.6 U	60.8 U	80.7 U	47.8 U	53.3 U	55.6 U	47.6 U
Selenium	0.97 U	1.2	1.1 U	1.1 U	1 U	1 U	1.1 U
Silver	0.21 U	0.17 J	0.17 U	0.22 J	0.17 U	0.33 J	0.18 U
Sodium	380 U	400 U	398 U	424 U	474 U	375 U	473 U
Thallium	1.2 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.4 U
Vanadium	1.8 J	3.2 J	2.9 J	1.3 J	1.7 J	1.5 J	1.2 J
Zinc	42.4 J	389 J	21.1 J	205 J	34.3 J	39.2 J	5.1 J

Appendix B-2

Validated Analytical Results
Subsurface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00603	38S00803	38S00903
Sampling Date	5/6/97	5/6/97	5/6/97
Volatile organics, ug/kg			
1,1,1-Trichloroethane	12 UJ	12 U	13 U
1,1,2,2-Tetrachloroethane	12 UJ	12 U	13 U
1,1,2-Trichloroethane	12 UJ	12 U	13 U
1,1-Dichloroethane	12 UJ	12 U	13 U
1,1-Dichloroethene	12 UJ	12 U	13 U
1,2-Dichloroethane	12 UJ	12 U	13 U
1,2-Dichloroethene (total)	12 UJ	12 U	13 U
1,2-Dichloropropane	12 UJ	12 U	13 U
2-Butanone	12 UJ	12 UJ	13 UJ
2-Hexanone	12 UJ	12 UJ	13 UJ
4-Methyl-2-pentanone	12 UJ	12 U	13 U
Acetone	130 J	12 UJ	13 UJ
Benzene	12 UJ	12 U	13 U
Bromodichloromethane	12 UJ	12 U	13 U
Bromoform	12 UJ	12 U	13 U
Bromomethane	12 UJ	12 U	13 U
Carbon disulfide	12 UJ	12 U	13 U
Carbon tetrachloride	12 UJ	12 U	13 U
Chlorobenzene	12 UJ	12 U	13 U
Chloroethane	12 UJ	12 U	13 U
Chloroform	12 UJ	12 U	13 U
Chloromethane	12 UJ	12 U	13 U
cis-1,3-Dichloropropene	12 UJ	12 U	13 U
Dibromochloromethane	12 UJ	12 U	13 U
Ethylbenzene	25 J	12 U	13 U
Methylene chloride	12 UJ	2 J	3 J
Styrene	12 UJ	12 U	13 U
Tetrachloroethene	12 UJ	12 U	13 U
Toluene	3 J	12 U	13 U
trans-1,3-Dichloropropene	12 UJ	12 U	13 U
Trichloroethene	12 UJ	12 U	13 U
Vinyl chloride	12 UJ	12 U	13 U
Xylene (total)	250 J	12 U	13 U
Semivolatile organics, ug/kg			
1,2,4-Trichlorobenzene	3800 U	390 U	420 U
1,2-Dichlorobenzene	3800 U	390 U	420 U

Appendix B-2

Validated Analytical Results Subsurface Soil - TAL Metals and TCL Organics PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00603	38S00803	38S00903
Sampling Date	5/6/97	5/6/97	5/6/97
1,3-Dichlorobenzene	3800 U	390 U	420 U
1,4-Dichlorobenzene	3800 U	390 U	420 U
2,2'-oxybis(1-Chloropropane)	3800 U	390 U	420 U
2,4,5-Trichlorophenol	9700 U	980 U	1000 U
2,4,6-Trichlorophenol	3800 U	390 U	420 U
2,4-Dichlorophenol	3800 U	390 U	420 U
2,4-Dimethylphenol	3800 U	390 U	420 U
2,4-Dinitrophenol	9700 U	980 U	1000 U
2,4-Dinitrotoluene	3800 U	390 U	420 U
2,6-Dinitrotoluene	3800 U	390 U	420 U
2-Chloronaphthalene	3800 U	390 U	420 U
2-Chlorophenol	3800 U	390 U	420 U
2-Methylnaphthalene	4300	390 U	420 U
2-Methylphenol	3800 U	390 U	420 U
2-Nitroaniline	9700 U	980 U	1000 U
2-Nitrophenol	3800 U	390 U	420 U
3,3'-Dichlorobenzidine	3800 U	390 U	420 U
3-Nitroaniline	9700 U	980 U	1000 U
4,6-Dinitro-2-methylphenol	9700 U	980 U	1000 U
4-Bromophenyl-phenylether	3800 U	390 UJ	420 U
4-Chloro-3-methylphenol	3800 U	390 U	420 U
4-Chloroaniline	3800 U	390 U	420 U
4-Chlorophenyl-phenylether	3800 U	390 U	420 UJ
4-Methylphenol	3800 U	390 U	420 U
4-Nitroaniline	9700 U	980 U	1000 U
4-Nitrophenol	9700 U	980 UJ	1000 UJ
Acenaphthene	3800 U	390 U	420 U
Acenaphthylene	3800 U	390 U	420 U
Anthracene	3800 U	390 U	420 U
Benzo(a)anthracene	3800 U	390 U	420 U
Benzo(a)pyrene	3800 U	390 U	420 U
Benzo(b)fluoranthene	3800 U	390 U	420 U
Benzo(g,h,i)perylene	3800 U	390 U	420 U
Benzo(k)fluoranthene	3800 U	390 U	420 U
bis(2-Chloroethoxy)methane	3800 U	390 U	420 U
bis(2-Chloroethyl)ether	3800 U	390 U	420 U
bis(2-Ethylhexyl)phthalate	2300 J	320 J	420 U

Appendix B-2

Validated Analytical Results
Subsurface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00603	38S00803	38S00903
Sampling Date	5/6/97	5/6/97	5/6/97
Butylbenzylphthalate	3800 U	390 U	420 U
Carbazole	3800 U	390 U	420 U
Chrysene	3800 U	390 U	420 U
Di-n-butylphthalate	3800 U	390 U	420 U
Di-n-octylphthalate	3800 U	390 U	420 U
Dibenz(a,h)anthracene	3800 U	390 U	420 U
Dibenzofuran	3800 U	390 U	420 U
Diethylphthalate	3800 U	390 U	420 U
Dimethylphthalate	3800 U	390 U	420 U
Fluoranthene	3800 U	390 U	420 U
Fluorene	3800 U	390 UJ	420 UJ
Hexachlorobenzene	3800 U	390 U	420 U
Hexachlorobutadiene	3800 U	390 U	420 U
Hexachlorocyclopentadiene	3800 U	390 U	420 U
Hexachloroethane	3800 U	390 U	420 U
Indeno(1,2,3-cd)pyrene	3800 U	390 U	420 U
Isophorone	3800 U	390 U	420 U
N-Nitroso-di-n-propylamine	3800 U	390 UJ	420 UJ
N-Nitrosodiphenylamine (1)	3800 U	390 U	420 U
Naphthalene	5200	390 U	420 U
Nitrobenzene	3800 U	390 U	420 U
Pentachlorophenol	9700 U	980 U	1000 U
Phenanthrene	3800 U	390 U	420 U
Phenol	3800 U	390 U	420 U
Pyrene	3800 U	390 U	420 U
Pesticides/PCBs, ug/kg			
4,4'-DDD	3.9 U	3.9 UJ	21
4,4'-DDE	4.9	2.6 J	9.9
4,4'-DDT	3.9 UJ	3.9 UJ	4.1 UJ
Aldrin	2.1 J	0.15 J	2.1 U
alpha-BHC	0.85 J	2 U	2.1 U
alpha-Chlordane	23	0.54 J	2.1 U
Aroclor-1016	39 U	39 U	41 U
Aroclor-1221	78 U	79 U	84 U
Aroclor-1232	39 U	39 U	41 U
Aroclor-1242	39 U	39 U	41 U
Aroclor-1248	39 U	39 U	41 U

Appendix B-2

Validated Analytical Results
Subsurface Soil - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00603	38S00803	38S00903
Sampling Date	5/6/97	5/6/97	5/6/97
Aroclor-1254	39 U	39 U	41 U
Aroclor-1260	39 U	30 J	41 U
beta-BHC	2 U	2 U	2.1 U
delta-BHC	2 U	0.38 J	2.1 U
Dieldrin	3.9 U	0.6 J	0.17 J
Endosulfan I	2 U	0.2 J	0.83 J
Endosulfan II	3.9 U	1.2 J	4.1 U
Endosulfan sulfate	2.2 J	0.98 J	4.1 U
Endrin	1.4 J	2.8 J	4.1 U
Endrin aldehyde	3.9 U	1.8 J	1.1 J
Endrin ketone	0.47 J	3.9 U	1.7 J
gamma-BHC (Lindane)	0.83 J	2 U	2.1 U
gamma-Chlordane	22	2 UJ	2.1 UJ
Heptachlor	0.18 J	0.1 J	2.1 U
Heptachlor epoxide	2 U	0.18 J	2.1 U
Methoxychlor	20 UJ	20 U	21 UJ
Toxaphene	200 U	200 U	210 U
Inorganics, mg/kg			
Aluminum	1250 J	456 J	227 J
Antimony	0.56 U	0.57 U	0.61 U
Arsenic	0.66 U	0.67 U	0.71 U
Barium	5.7 J	1.8 J	3.8 J
Beryllium	0.07 U	0.05 U	0.05 U
Cadmium	0.21 U	0.1 U	0.1 U
Calcium	979 J	50.1 J	554 J
Chromium	5	4	1.3 J
Cobalt	0.21 U	0.22 U	0.23 U
Copper	1.5 J	1.3 J	1.5 J
Iron	4210	233	163
Lead	21.5	5	3.6
Magnesium	62 J	13.3 U	38.7 J
Manganese	5.4	1.4 J	2 J
Mercury	0.07 UJ	0.07 U	0.06 U
Nickel	0.3 U	0.4 J	0.33 U
Potassium	50.8 U	44.5 J	69.8 U
Selenium	1 U	1 U	1.1 U
Silver	0.16 U	0.17 U	0.18 U

Appendix B-2

Validated Analytical Results Subsurface Soil - TAL Metals and TCL Organics PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38S00603	38S00803	38S00903
Sampling Date	5/6/97	5/6/97	5/6/97
Sodium	382 U	441 U	450 U
Thallium	1.3 U	1.3 U	1.4 U
Vanadium	2.9 J	1.1 J	1.1 J
Zinc	26.1 J	6.9 J	6.3 J

Appendix B-3

Validated Analytical Results Groundwater - TAL Metals and TCL Organics PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38G00101	38G00201
Sampling Date	4/22/97	4/24/97
Volatile organics, ug/L		
1,1,1-Trichloroethane	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U
1,1-Dichloroethane	10 U	2 J
1,1-Dichloroethene	10 U	10 U
1,2-Dichloroethane	10 U	10 UJ
1,2-Dichloroethene (total)	10 U	73
1,2-Dichloropropane	10 U	10 U
2-Butanone	10 UJ	10 UJ
2-Hexanone	10 U	10 U
4-Methyl-2-pentanone	10 U	10 U
Acetone	10 U	10 UJ
Benzene	10 U	10 U
Bromodichloromethane	10 U	10 U
Bromoform	10 U	10 U
Bromomethane	10 U	10 U
Carbon disulfide	10 U	10 U
Carbon tetrachloride	10 U	10 U
Chlorobenzene	10 U	10 U
Chloroethane	10 U	10 U
Chloroform	10 U	10 U
Chloromethane	10 U	10 UJ
cis-1,3-Dichloropropene	10 U	10 U
Dibromochloromethane	10 U	10 U
Ethylbenzene	10 U	10 U
Methylene chloride	10 U	10 U
Styrene	10 U	10 U
Tetrachloroethene	10 U	10 U
Toluene	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U
Trichloroethene	10 U	24
Vinyl chloride	10 U	57
Xylene (total)	10 U	10 U
Semivolatile organics, ug/L		
1,2,4-Trichlorobenzene	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U

Appendix B-3

Validated Analytical Results Groundwater - TAL Metals and TCL Organics PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38G00101	38G00201
Sampling Date	4/22/97	4/24/97
1,3-Dichlorobenzene	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U
2,2'-oxybis(1-Chloropropane)	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U
2,4,6-Trichlorophenol	10 U	10 U
2,4-Dichlorophenol	10 U	10 U
2,4-Dimethylphenol	10 U	10 U
2,4-Dinitrophenol	25 U	25 U
2,4-Dinitrotoluene	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U
2-Chloronaphthalene	10 U	10 U
2-Chlorophenol	10 U	10 U
2-Methylnaphthalene	10 U	10 U
2-Methylphenol	10 U	10 U
2-Nitroaniline	25 U	25 U
2-Nitrophenol	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U
3-Nitroaniline	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U
4-Bromophenyl-phenylether	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U
4-Chloroaniline	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U
4-Methylphenol	10 U	10 U
4-Nitroaniline	25 U	25 U
4-Nitrophenol	25 U	25 U
Acenaphthene	10 U	10 U
Acenaphthylene	10 U	10 U
Anthracene	10 U	10 U
Benzo(a)anthracene	10 U	10 U
Benzo(a)pyrene	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U
bis(2-Ethylhexyl)phthalate	10 U	10 U

Appendix B-3

Validated Analytical Results
Groundwater - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38G00101	38G00201
Sampling Date	4/22/97	4/24/97
Butylbenzylphthalate	10 U	10 U
Carbazole	10 U	10 U
Chrysene	10 U	10 U
Di-n-butylphthalate	10 U	10 U
Di-n-octylphthalate	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U
Dibenzofuran	10 U	10 U
Diethylphthalate	10 U	10 U
Dimethylphthalate	10 U	10 U
Fluoranthene	10 U	10 U
Fluorene	10 U	10 U
Hexachlorobenzene	10 U	10 U
Hexachlorobutadiene	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U
Hexachloroethane	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U
Isophorone	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U
N-Nitrosodiphenylamine (1)	10 U	10 U
Naphthalene	10 U	10 U
Nitrobenzene	10 U	10 U
Pentachlorophenol	25 U	25 U
Phenanthrene	10 U	10 U
Phenol	10 U	10 U
Pyrene	10 U	10 U
Pesticides/PCBs, ug/L		
4,4'-DDD	0.1 U	0.1 U
4,4'-DDE	0.1 U	0.1 U
4,4'-DDT	0.1 U	0.1 U
Aldrin	0.05 U	0.05 U
alpha-BHC	0.05 U	0.05 U
alpha-Chlordane	0.05 U	0.05 U
Aroclor-1016	1 U	1 U
Aroclor-1221	2 U	2 U
Aroclor-1232	1 U	1 U
Aroclor-1242	1 U	1 U
Aroclor-1248	1 U	1 U

Appendix B-3

**Validated Analytical Results
Groundwater - TAL Metals and TCL Organics
PSC 38**

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38G00101	38G00201
Sampling Date	4/22/97	4/24/97
Aroclor-1254	1 U	1 U
Aroclor-1260	1 U	1 U
beta-BHC	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U
Dieldrin	0.1 U	0.1 U
Endosulfan I	0.05 U	0.05 U
Endosulfan II	0.1 U	0.1 U
Endosulfan sulfate	0.1 U	0.1 U
Endrin	0.1 U	0.1 U
Endrin aldehyde	0.1 U	0.1 U
Endrin ketone	0.1 U	0.1 U
gamma-BHC (Lindane)	0.05 U	0.05 U
gamma-Chlordane	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U
Heptachlor epoxide	0.05 U	0.05 U
Methoxychlor	0.5 U	0.5 U
Toxaphene	5 U	5 U
Inorganics ug/L		
Aluminum	489	806
Antimony	2.4 U	2.4 U
Arsenic	3.8 J	4 J
Barium	52.6 J	126 J
Beryllium	0.2 U	0.2 U
Cadmium	0.4 U	0.4 U
Calcium	8830	50900
Chromium	1.4 J	1.6 J
Cobalt	0.9 U	1.9 U
Copper	5 J	4.5 U
Iron	8700	50300
Lead	2.2 U	2.2 U
Magnesium	3220 J	11200
Manganese	85.8	138
Mercury	0.12 J	0.13 J
Nickel	2.4 J	5.2 J
Potassium	742 J	1260 J
Selenium	4.3 U	4.3 U
Silver	0.7 U	0.7 U

Appendix B-3

Validated Analytical Results Groundwater - TAL Metals and TCL Organics PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38G00101	38G00201
Sampling Date	4/22/97	4/24/97
Sodium	4110 J	20900 J
Thallium	5.5 U	5.5 U
Vanadium	5.1 U	3.2 U
Zinc	5.3 J	1.8 J

Appendix B-4

Validated Analytical Results
Sediment - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38D00101	38D00201
Sampling Date	28-Aug-97	28-Aug-97
Volatile Organics, ug/kg		
1,1,1-Trichloroethane	14 U	21 U
1,1,2,2-Tetrachloroethane	14 U	21 U
1,1,2-Trichloroethane	14 U	21 U
1,1-Dichloroethane	14 U	21 U
1,1-Dichloroethene	14 U	21 U
1,2-Dichloroethane	14 U	21 U
1,2-Dichloroethene (total)	14 U	21 U
1,2-Dichloropropane	14 U	21 U
2-Butanone	14 UJ	21 UJ
2-Hexanone	14 UJ	21 UJ
4-Methyl-2-pentanone	14 U	21 U
Acetone	14 UJ	21 UJ
Benzene	14 U	21 U
Bromodichloromethane	14 U	21 U
Bromoform	14 U	21 U
Bromomethane	14 U	21 U
Carbon disulfide	14 U	21 U
Carbon tetrachloride	14 U	21 U
Chlorobenzene	14 U	21 U
Chloroethane	14 U	21 U
Chloroform	14 U	21 U
Chloromethane	14 UJ	21 UJ
cis-1,3-Dichloropropene	14 U	21 U
Dibromochloromethane	14 U	21 U
Ethylbenzene	14 U	21 U
Methylene chloride	14 U	21 U
Styrene	14 U	21 U
Tetrachloroethene	14 UJ	21 UJ
Toluene	14 U	21 U
trans-1,3-Dichloropropene	14 U	21 U
Trichloroethene	14 U	21 U
Vinyl chloride	14 UJ	21 UJ
Xylene (total)	14 U	21 U
Semivolatile Organics, ug/kg		
1,2,4-Trichlorobenzene	460 U	700 U
1,2-Dichlorobenzene	460 U	700 U
1,3-Dichlorobenzene	460 U	700 U

Appendix B-4

Validated Analytical Results
Sediment - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38D00101	38D00201
Sampling Date	28-Aug-97	28-Aug-97
1,4-Dichlorobenzene	460 U	700 U
2,2'-oxybis(1-Chloropropane)	460 U	700 U
2,4,5-Trichlorophenol	1200 U	1800 U
2,4,6-Trichlorophenol	460 U	700 U
2,4-Dichlorophenol	460 U	700 U
2,4-Dimethylphenol	460 U	700 U
2,4-Dinitrophenol	1200 U	1800 U
2,4-Dinitrotoluene	460 U	700 U
2,6-Dinitrotoluene	460 U	700 U
2-Chloronaphthalene	460 U	700 U
2-Chlorophenol	460 U	700 U
2-Methylnaphthalene	460 U	700 U
2-Methylphenol	460 U	700 U
2-Nitroaniline	1200 U	1800 U
2-Nitrophenol	460 U	700 U
3,3'-Dichlorobenzidine	460 U	700 U
3-Nitroaniline	1200 U	1800 U
4,6-Dinitro-2-methylphenol	1200 U	1800 U
4-Bromophenyl-phenylether	460 U	700 U
4-Chloro-3-methylphenol	460 U	700 U
4-Chloroaniline	460 U	700 U
4-Chlorophenyl-phenylether	460 UJ	700 UJ
4-Methylphenol	460 U	700 U
4-Nitroaniline	1200 U	1800 U
4-Nitrophenol	1200 U	1800 U
Acenaphthene	460 U	700 U
Acenaphthylene	460 U	700 U
Anthracene	460 U	700 U
Benzo(a)anthracene	460 U	700 U
Benzo(a)pyrene	460 U	700 U
Benzo(b)fluoranthene	460 U	700 U
Benzo(g,h,i)perylene	460 U	700 U
Benzo(k)fluoranthene	460 U	700 U
bis(2-Chloroethoxy)methane	460 U	700 U
bis(2-Chloroethyl)ether	460 U	700 U
bis(2-Ethylhexyl)phthalate	460 U	700 U
Butylbenzylphthalate	460 U	700 U
Carbazole	460 U	700 U

Appendix B-4

Validated Analytical Results
Sediment - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38D00101	38D00201
Sampling Date	28-Aug-97	28-Aug-97
Chrysene	460 U	700 U
Di-n-butylphthalate	460 U	700 U
Di-n-octylphthalate	460 U	700 U
Dibenz(a,h)anthracene	460 U	700 U
Dibenzofuran	460 U	700 U
Diethylphthalate	460 U	700 U
Dimethylphthalate	460 U	700 U
Fluoranthene	460 U	700 U
Fluorene	460 U	700 U
Hexachlorobenzene	460 U	700 U
Hexachlorobutadiene	460 U	700 U
Hexachlorocyclopentadiene	460 U	700 U
Hexachloroethane	460 U	700 U
Indeno(1,2,3-cd)pyrene	460 U	700 U
Isophorone	460 U	700 U
N-Nitroso-di-n-propylamine	460 U	700 U
N-Nitrosodiphenylamine (1)	460 U	700 U
Naphthalene	460 U	700 U
Nitrobenzene	460 U	700 U
Pentachlorophenol	1200 U	1800 U
Phenanthrene	460 U	700 U
Phenol	460 U	700 U
Pyrene	460 U	700 U
Pesticides/PCBs, ug/kg		
4,4'-DDD	4.6 U	7 U
4,4'-DDE	0.45 J	0.83 J
4,4'-DDT	4.6 UJ	7 UJ
Aldrin	2.4 U	3.6 U
alpha-BHC	2.4 U	3.6 U
alpha-Chlordane	2.4 U	3.6 U
Aroclor-1016	46 U	70 U
Aroclor-1221	94 U	140 U
Aroclor-1232	46 U	70 U
Aroclor-1242	46 U	70 U
Aroclor-1248	46 U	70 U
Aroclor-1254	46 U	70 U
Aroclor-1260	46 U	70 U
beta-BHC	2.4 U	3.6 U

Appendix B-4

Validated Analytical Results
Sediment - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38D00101	38D00201
Sampling Date	28-Aug-97	28-Aug-97
delta-BHC	2.4 UJ	3.6 UJ
Dieldrin	4.6 U	7 U
Endosulfan I	2.4 U	3.6 U
Endosulfan II	4.6 U	7 U
Endosulfan sulfate	4.6 U	7 U
Endrin	4.6 U	7 U
Endrin aldehyde	4.6 U	0.48 J
Endrin ketone	4.6 U	7 U
gamma-BHC (Lindane)	2.4 U	3.6 U
gamma-Chlordane	2.4 U	3.6 UJ
Heptachlor	0.15 J	0.17 J
Heptachlor epoxide	2.4 U	3.6 U
Methoxychlor	24 U	36 U
Toxaphene	240 U	360 U
Inorganics, mg/kg		
Aluminum	962 J	3720 J
Antimony	0.81 UJ	1.2 UJ
Arsenic	1.7 U	2.3 U
Barium	4 J	26.6 J
Beryllium	0.03 U	0.12 J
Cadmium	0.08 U	0.26 J
Calcium	72.5 J	3470 J
Chromium	1.3 J	6.9
Cobalt	0.2 U	0.47 J
Copper	1.4 U	15.5
Iron	207 J	7090 J
Lead	2.6	17
Magnesium	34.6 J	223 J
Manganese	1.9 U	12.4
Mercury	0.07 UJ	0.13 J
Nickel	0.57 J	2.4 J
Potassium	36.6 J	123 J
Selenium	1.2 U	2.2
Silver	0.22 U	1.8 J
Sodium	202 U	323 U
Thallium	1.4 U	2 U
Vanadium	1.5 J	9.1 J
Zinc	8.8 J	50 J

Appendix B-5

Validated Analytical Results
Surface Water - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38W00101
Sampling Date	28-Aug-97
Volatile Organics, ug/L	
1,1,1-Trichloroethane	10 U
1,1,2,2-Tetrachloroethane	10 U
1,1,2-Trichloroethane	10 U
1,1-Dichloroethane	10 U
1,1-Dichloroethene	10 U
1,2-Dichloroethane	10 U
1,2-Dichloroethene (total)	10 U
1,2-Dichloropropane	10 U
2-Butanone	10 U
2-Hexanone	10 U
4-Methyl-2-pentanone	10 U
Acetone	10 U
Benzene	10 U
Bromodichloromethane	10 U
Bromoform	10 U
Bromomethane	10 U
Carbon disulfide	10 U
Carbon tetrachloride	10 U
Chlorobenzene	10 U
Chloroethane	10 U
Chloroform	10 U
Chloromethane	10 U
cis-1,3-Dichloropropene	10 U
Dibromochloromethane	10 U
Ethylbenzene	10 U
Methylene chloride	10 U
Styrene	10 U
Tetrachloroethene	10 U
Toluene	10 U
trans-1,3-Dichloropropene	10 U
Trichloroethene	10 U
Vinyl chloride	10 U
Xylene (total)	10 U
Semivolatile Organics, ug/L	
1,2,4-Trichlorobenzene	10 U
1,2-Dichlorobenzene	10 U

Appendix B-5

Validated Analytical Results
Surface Water - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38W00101
Sampling Date	28-Aug-97
1,3-Dichlorobenzene	10 U
1,4-Dichlorobenzene	10 U
2,2'-oxybis(1-Chloropropane)	10 U
2,4,5-Trichlorophenol	25 U
2,4,6-Trichlorophenol	10 U
2,4-Dichlorophenol	10 U
2,4-Dimethylphenol	10 U
2,4-Dinitrophenol	25 U
2,4-Dinitrotoluene	10 U
2,6-Dinitrotoluene	10 U
2-Chloronaphthalene	10 U
2-Chlorophenol	10 U
2-Methylnaphthalene	10 U
2-Methylphenol	10 U
2-Nitroaniline	25 U
2-Nitrophenol	10 U
3,3'-Dichlorobenzidine	10 U
3-Nitroaniline	25 U
4,6-Dinitro-2-methylphenol	25 U
4-Bromophenyl-phenylether	10 U
4-Chloro-3-methylphenol	10 U
4-Chloroaniline	10 U
4-Chlorophenyl-phenylether	10 U
4-Methylphenol	10 U
4-Nitroaniline	25 U
4-Nitrophenol	25 UJ
Acenaphthene	10 U
Acenaphthylene	10 U
Anthracene	10 U
Benzo(a)anthracene	10 U
Benzo(a)pyrene	10 U
Benzo(b)fluoranthene	10 U
Benzo(g,h,i)perylene	10 U
Benzo(k)fluoranthene	10 U
bis(2-Chloroethoxy)methane	10 U
bis(2-Chloroethyl)ether	10 U
bis(2-Ethylhexyl)phthalate	10 U

Appendix B-5

Validated Analytical Results Surface Water - TAL Metals and TCL Organics PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38W00101
Sampling Date	28-Aug-97
Butylbenzylphthalate	10 U
Carbazole	10 U
Chrysene	10 U
Di-n-butylphthalate	3 J
Di-n-octylphthalate	10 U
Dibenz(a,h)anthracene	10 U
Dibenzofuran	10 U
Diethylphthalate	10 U
Dimethylphthalate	10 U
Fluoranthene	10 U
Fluorene	10 U
Hexachlorobenzene	10 U
Hexachlorobutadiene	10 U
Hexachlorocyclopentadiene	10 U
Hexachloroethane	10 U
Indeno(1,2,3-cd)pyrene	10 U
Isophorone	10 U
N-Nitroso-di-n-propylamine	10 U
N-Nitrosodiphenylamine (1)	10 U
Naphthalene	10 U
Nitrobenzene	10 U
Pentachlorophenol	25 U
Phenanthrene	10 U
Phenol	10 U
Pyrene	10 U
Pesticides/PCBs, ug/L	
4,4'-DDD	0.1 U
4,4'-DDE	0.1 U
4,4'-DDT	0.1 U
Aldrin	0.05 U
alpha-BHC	0.05 U
alpha-Chlordane	0.05 U
Aroclor-1016	1 U
Aroclor-1221	2 U
Aroclor-1232	1 U
Aroclor-1242	1 U
Aroclor-1248	1 U

Appendix B-5

Validated Analytical Results
Surface Water - TAL Metals and TCL Organics
PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38W00101
Sampling Date	28-Aug-97
Aroclor-1254	1 U
Aroclor-1260	1 U
beta-BHC	0.05 U
delta-BHC	0.05 U
Dieldrin	0.1 U
Endosulfan I	0.05 U
Endosulfan II	0.1 U
Endosulfan sulfate	0.1 U
Endrin	0.1 U
Endrin aldehyde	0.1 U
Endrin ketone	0.1 U
gamma-BHC (Lindane)	0.05 U
gamma-Chlordane	0.05 U
Heptachlor	0.05 U
Heptachlor epoxide	0.05 U
Methoxychlor	0.5 U
Toxaphene	5 U
Inorganics, ug/L	
Aluminum	368
Antimony	2.9 U
Arsenic	5.9 U
Barium	38.4 J
Beryllium	0.1 U
Cadmium	0.3 U
Calcium	9330
Chromium	2.2 J
Cobalt	0.7 U
Copper	4.2 J
Iron	2690
Lead	2.9 U
Magnesium	2570 J
Manganese	51.2
Mercury	0.1 U
Nickel	1.6 J
Potassium	592 J
Selenium	4.4 U
Silver	0.8 U

Appendix B-5

Validated Analytical Results Surface Water - TAL Metals and TCL Organics PSC 38

Naval Air Station, Jacksonville
Jacksonville, FL

Sample ID	38W00101
Sampling Date	28-Aug-97
Sodium	7550
Thallium	5 U
Vanadium	1.4 J
Zinc	35.8 J

Appendix B-1, B-2, B-3, B-4 and B-5

**Notes for Validated Analytical Results Tables
PSC 8**

Naval Air Station Jacksonville
Jacksonville, Florida

Sample ID = Sample Identifier

Lab ID = Laboratory identifier

Units:

mg/kg milligram per kilogram

ug/kg microgram per kilogram

ug/L microgram per liter

The following standard validation qualifiers have the following definitions:

U The analyte/compound was analyzed for but was not detected above the reported sample quantitation limit
The number preceding the U qualifier is the reported sample quantitation limit.

J The analyte/compound was positively identified and the associated numerical value is an estimated concentration of the analyte/compound in the sample.

For most detected analytes and compounds, the J qualifier is also used to indicate that the reported concentration is below the contract required detection or quantitation limit.

UU The analyte/compound was not detected above the reported sample quantitation limit.
The reported quantitation limit, however, is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte/compound in the sample.

APPENDIX C

SUMMARY OF DETECTIONS IN ANALYTICAL RESULTS

**APPENDIX C
SUMMARY OF DETECTIONS**

Naval Air Station Jacksonville
Jacksonville, FL

Surface Soil								
Parameter	Frequency of Detects	Range of Detects	Range of CRQLs	Average (Detects)	Average (All)	Maximum Detected	95% UCL	EPC
Volatile Organics (ug/kg)								
Acetone	8/18	15 - 220	11 - 13	90.3	43.4	220	133	133
Methylene chloride	15/18	1 - 3	11 - 13	1.9	2.6	3	3.4	3
Semivolatile Organics (ug/kg)								
2,4-Dimethylphenol	1/18	300 - 300	360 - 1,800	300	243	300	281	281
2-Methylnaphthalene	1/18	40 - 40	360 - 1,800	40	229	40	296	40
Benzo(b)fluoranthene	1/18	64 - 64	360 - 1,800	64	230	64	281	64
Benzo(k)fluoranthene	1/18	56 - 56	360 - 1,800	56	229	56	284	56
Naphthalene	1/18	80 - 80	360 - 1,800	80	231	80	273	80
bis(2-Ethylhexyl)phthalate	11/18	48 - 1,700	360 - 1,800	310	267	1,700	446	446
Pesticides/PCBs (ug/kg)								
4,4'-DDE	13/18	0.22 - 6.4	3.8 - 10	1.9	1.9	6.4	3.5	3.5
4,4'-DDT	1/18	7.7 - 7.7	3.6 - 10	7.7	2.5	7.7	2.9	2.9
Aldrin	3/18	0.2 - 1.2	1.8 - 5	0.6	0.96	1.2	1.2	1.2
Aroclor-1242	2/18	62 - 71	36 - 98	66.5	24.9	71	29.7	29.7
Aroclor-1260	10/18	8.2 - 180	37 - 100	46.1	34.5	180	48.9	48.9
Dieldrin	7/18	0.15 - 1.2	3.6 - 10	0.48	1.4	1.2	3	1.2
Endosulfan I	1/18	0.086 - 0.086	1.8 - 5	0.09	0.97	0.09	1.4	0.09
Endosulfan II	3/18	0.58 - 5.5	3.6 - 10	2.6	2.1	5.5	2.5	2.5
Endosulfan sulfate	4/18	0.1 - 12	3.6 - 10	3.6	2.3	12	4.3	4.3
Endrin	5/18	0.2 - 4.2	3.6 - 10	1.1	1.8	4.2	3.2	3.2
Endrin aldehyde	5/18	0.4 - 4.5	3.6 - 10	1.9	2	4.5	2.7	2.7
Endrin ketone	4/18	0 - 1.5	3.6 - 10	0.68	1.7	1.5	2.2	1.5
Heptachlor	1/18	0.11 - 0.11	1.8 - 5	0.11	0.97	0.11	1.4	0.11
Heptachlor epoxide	4/18	0.19 - 0.81	1.8 - 5	0.51	0.91	0.81	1.2	0.81
alpha-BHC	1/18	0.086 - 0.086	1.8 - 5	0.09	0.96	0.09	1.4	0.09
alpha-Chlordane	14/18	0.15 - 18	1.9 - 5	3.6	3	18	10.3	10.3
delta-BHC	1/18	0.13 - 0.13	1.8 - 5	0.13	0.97	0.13	1.3	0.13
gamma-BHC (Lindane)	1/18	0.26 - 0.26	1.8 - 5	0.26	0.98	0.26	1.2	0.26
gamma-Chlordane	18/18	0.18 - 22	5 - 5	2.8	2.8	22	9.7	9.7
Inorganics (mg/kg)								
Aluminum	18/18	528 - 2,140	32.3 - 37.8	1,037	1,037	2,140	1,249	1249

**APPENDIX C
SUMMARY OF DETECTIONS**

Naval Air Station Jacksonville
Jacksonville, FL

Surface Soil								
Parameter	Frequency of Detects	Range of Detects	Range of CRQLs	Average (Detects)	Average (All)	Maximum Detected	95% UCL	EPC
Antimony	1/18	1.9 - 1.9	0.53 - 5.7	1.9	0.38	1.9	0.44	0.44
Barium	18/18	1.5 - 23.1	0.44 - 0.51	7.8	7.8	23.1	11.9	11.9
Cadmium	5/18	0.11 - 11	0.09 - 0.98	3.7	1.1	11	3.4	3.4
Calcium	18/18	134 - 71,600	16 - 18.8	4,660	4,660	71,600	5,115	5115
Chromium	18/18	1 - 270	2 - 2.3	20	20	270	34.1	34.1
Cobalt	3/18	0.26 - 0.42	0.2 - 2.2	0.36	0.18	0.42	0.23	0.23
Copper	12/18	1.7 - 153	1.2 - 17.4	28.8	20	153	57.4	57.4
Iron	18/18	151 - 3,420	31.8 - 37.3	990	990	3,420	1,920	1920
Lead	18/18	1.7 - 2,350	4.8 - 5.7	160	160	2,350	446	446
Magnesium	16/18	26.5 - 490	14 - 22.2	85.2	76.8	490	128	128
Manganese	18/18	0.61 - 31.2	0.22 - 0.26	6	6	31.2	11.1	11.1
Mercury	2/18	0.06 - 0.08	0.05 - 0.12	0.07	0.04	0.08	0.04	0.04
Nickel	14/18	0.34 - 2.1	0.31 - 3.3	0.8	0.65	2.1	1.1	1.1
Potassium	2/18	79.4 - 81.7	36.1 - 80.7	80.6	31.5	81.7	38.5	38.5
Selenium	1/18	1.2 - 1.2	0.94 - 9.9	1.2	0.55	1.2	0.61	0.61
Silver	5/18	0.17 - 6.3	0.17 - 1.7	1.4	0.47	6.3	0.48	0.48
Vanadium	18/18	1.2 - 5.5	1.8 - 2	2.4	2.4	5.5	3	3
Zinc	18/18	3.4 - 389	0.66 - 0.77	55.5	55.5	389	158	158
NOTES: ug/kg = microgram per kilogram mg/kg = milligram per kilogram PCBs = Polychlorinated Biphenyls CRQL = Contract Required Quantitation Limits UCL = Upper confidence limit. EPC = Exposure point concentration. Exposure point concentration is defined as the lesser of the maximum detected concentration and the 95% UCL.								

APPENDIX C
SUMMARY OF DETECTIONS

Naval Air Station Jacksonville
Jacksonville, FL

Subsurface Soil						
Parameter	Frequency of Detects	Range of Detects	Range of CRQLs	Average (Detects)	Average (All)	Maximum Detected
Volatile Organics (ug/kg)						
Acetone	1/3	130 - 130	12 - 13	130	47.5	130
Ethylbenzene	1/3	25 - 25	12 - 13	25	12.5	25
Methylene chloride	2/3	2 - 3	12 - 13	2.5	3.7	3
Toluene	1/3	3 - 3	12 - 13	3	5.2	3
Xylene (total)	1/3	250 - 250	12 - 13	250	87.5	250
Semivolatile Organics (ug/kg)						
2-Methylnaphthalene	1/3	4,300 - 4,300	390 - 3,800	4300	1568	4300
Naphthalene	1/3	5,200 - 5,200	390 - 3,800	5200	1868	5200
bis(2-Ethylhexyl)phthalate	2/3	320 - 2,300	390 - 3,800	1310	943	2300
Pesticides/PCBs (ug/kg)						
4,4'-DDD	1/3	21 - 21	3.9 - 10	21	8.3	21
4,4'-DDE	3/3	2.6 - 9.9	10 - 10	5.8	5.8	9.9
Aldrin	2/3	0.15 - 2.1	2.1 - 5	1.1	1.1	2.1
Aroclor-1260	1/3	30 - 30	39 - 97	30	23.3	30
Dieldrin	2/3	0.17 - 0.6	3.9 - 10	0.39	0.91	0.6
Endosulfan I	2/3	0.2 - 0.83	2 - 5	0.52	0.68	0.83
Endosulfan II	1/3	1.2 - 1.2	3.9 - 10	1.2	1.7	1.2
Endosulfan sulfate	2/3	0.98 - 2.2	4.1 - 10	1.6	1.7	2.2
Endrin	2/3	1.4 - 2.8	4.1 - 10	2.1	2.1	2.8
Endrin aldehyde	2/3	1.1 - 1.8	3.9 - 10	1.5	1.6	1.8
Endrin ketone	2/3	0.47 - 1.7	3.9 - 10	1.1	1.4	1.7
Heptachlor	2/3	0.1 - 0.18	2.1 - 5	0.14	0.44	0.18
Heptachlor epoxide	1/3	0.18 - 0.18	2 - 5	0.18	0.74	0.18
alpha-BHC	1/3	0.85 - 0.85	2 - 5	0.85	0.97	0.85
alpha-Chlordane	2/3	0.54 - 23	2.1 - 5	11.8	8.2	23
delta-BHC	1/3	0.38 - 0.38	2 - 5	0.38	0.81	0.38
gamma-BHC (Lindane)	1/3	0.83 - 0.83	2 - 5	0.83	0.96	0.83
gamma-Chlordane	1/3	22 - 22	2 - 5	22	8	22
Inorganics (mg/kg)						
Aluminum	3/3	227 - 1,250	34.5 - 37.3	644	644	1250
Barium	3/3	1.8 - 5.7	0.47 - 0.51	3.8	3.8	5.7

**APPENDIX C
SUMMARY OF DETECTIONS**

Naval Air Station Jacksonville
Jacksonville, FL

Subsurface Soil						
Parameter	Frequency of Detects	Range of Detects	Range of CRQLs	Average (Detects)	Average (All)	Maximum Detected
Calcium	3/3	50.1 - 979	17.1 - 18.5	528	528	979
Chromium	3/3	1.3 - 5	2.1 - 2.3	3.4	3.4	5
Copper	3/3	1.3 - 1.5	1.4 - 1.5	1.4	1.4	1.5
Iron	3/3	163 - 4,210	34 - 36.8	1535	1535	4210
Lead	3/3	3.6 - 21.5	5.2 - 5.6	10	10	21.5
Magnesium	2/3	38.7 - 62	13.3 - 16.2	50.4	35.8	62
Manganese	3/3	1.4 - 5.4	0.23 - 0.25	2.9	2.9	5.4
Nickel	1/3	0.4 - 0.4	0.3 - 3.1	0.4	0.24	0.4
Potassium	1/3	44.5 - 44.5	50.8 - 69.8	44.5	34.9	44.5
Vanadium	3/3	1.1 - 2.9	1.9 - 2	1.7	1.7	2.9
Zinc	3/3	6.3 - 26.1	0.7 - 0.76	13.1	13.1	26.1
NOTES: CRQL = Contract Required Quantitation Limits PCBs = Polychlorinated Biphenyls						
				ug/kg = microgram per kilogram		
				mg/kg = milligram per kilogram		

APPENDIX C
SUMMARY OF DETECTIONS

Naval Air Station Jacksonville
Jacksonville, FL

Groundwater						
Parameter	Frequency of Detects	Range of Detects	Range of CRQLs	Average (Detects)	Average (All)	Maximum Detected
Volatile Organics (ug/l)						
1,1-Dichloroethane	1/2	2 - 2	10 - 10	2	3.5	2
1,2-Dichloroethene (total)	1/2	73 - 73	10 - 10	73	39	73
Trichloroethene	1/2	24 - 24	10 - 10	24	14.5	24
Vinyl chloride	1/2	57 - 57	10 - 10	57	31	57
Inorganics (ug/l)						
Aluminum	2/2	489 - 806	14.7 - 14.7	648	648	806
Arsenic	2/2	3.8 - 4	2.8 - 2.8	3.9	3.9	4
Barium	2/2	52.6 - 126	0.2 - 0.2	89.3	89.3	126
Calcium	2/2	8,830 - 50,900	7.3 - 7.3	29865	29865	50900
Chromium	2/2	1.4 - 1.6	0.9 - 0.9	1.5	1.5	1.6
Copper	1/2	5 - 5	0.6 - 4.5	5	3.6	5
Iron	2/2	8,700 - 50,300	14.5 - 14.5	29500	29500	50300
Magnesium	2/2	3,220 - 11,200	6.4 - 6.4	7210	7210	11200
Manganese	2/2	85.8 - 138	0.1 - 0.1	112	112	138
Mercury	2/2	0.12 - 0.13	0.1 - 0.1	0.13	0.13	0.13
Nickel	2/2	2.4 - 5.2	1.3 - 1.3	3.8	3.8	5.2
Potassium	2/2	742 - 1,260	27.7 - 27.7	1001	1001	1260
Sodium	2/2	4,110 - 20,900	220 - 220	12505	12505	20900
Zinc	2/2	1.8 - 5.3	0.3 - 0.3	3.6	3.6	5.3
NOTES:						
CRQL = Contract Required Quantitation Limits						
ug/l = microgram per liter						

**APPENDIX C
SUMMARY OF DETECTIONS**

Naval Air Station Jacksonville
Jacksonville, FL

Surface Water						
Parameter	Frequency of Detects	Range of Detects	CRQLs	Average (Detects)	Average (All)	Detections
Semivolatile Organic Compounds (ug/l)						
Di-n-butylphthalate	1/1	NA	.01	NA	NA	3
Inorganics (ug/l)						
Aluminum	1/1	NA	19.5	NA	NA	368
Barium	1/1	NA	.1	NA	NA	38.4
Calcium	1/1	NA	7.4	NA	NA	9,330
Chromium	1/1	NA	0.8	NA	NA	2.2
Copper	1/1	NA	0.6	NA	NA	4.2
Iron	1/1	NA	13.4	NA	NA	2690
Magnesium	1/1	NA	5.4	NA	NA	2570
Manganese	1/1	NA	0.1	NA	NA	51.2
Nickel	1/1	NA	1.3	NA	NA	1.6
Potassium	1/1	NA	30	NA	NA	592
Sodium	1/1	NA	286	NA	NA	7550
Vanadium	1/1	NA	0.7	NA	NA	1.4
Zinc	1/1	NA	0.3	NA	NA	35.8
NOTES: CRQL = Contract Required Quantitation Limits NA = Not applicable ug/l = microgram per liter						

**APPENDIX C
SUMMARY OF DETECTIONS**

Naval Air Station Jacksonville
Jacksonville, FL

Sediment						
Parameter	Frequency of Detects	Range of Detects	Range of CRQLs	Average (Detects)	Average (All)	Maximum Detected
Pesticides/PCBs (ug/kg)						
4,4'-DDE	2/2	0.45 - 0.83	12 - 18	0.64	0.64	0.83
Endrin aldehyde	1/2	0.48 - 0.48	4.6 - 18	0.48	1.4	0.48
Heptachlor	2/2	0.15 - 0.17	6 - 9	0.16	0.16	0.17
Inorganics (mg/kg)						
Aluminum	2/2	962 - 3,720	54.6 - 77.6	2341	2341	3720
Barium	2/2	4 - 26.6	0.28 - 0.4	15.3	15.3	26.6
Beryllium	1/2	0.12 - 0.12	0.03 - 0.4	0.12	0.07	0
Cadmium	1/2	0.26 - 0.26	0.08 - 1.2	0.26	0.15	0.26
Calcium	2/2	72.5 - 3,470	20.7 - 29.4	1771	1771	3470
Chromium	2/2	1.3 - 6.9	2.2 - 3.2	4.1	4.1	6.9
Cobalt	1/2	0.47 - 0.47	0.2 - 2.8	0.47	0.28	0.47
Copper	1/2	15.5 - 15.5	1.4 - 2.4	15.5	8.1	15.5
Iron	2/2	207 - 7,090	37.5 - 53.3	3649	3649	7090
Lead	2/2	2.6 - 17	5.3 - 7.6	9.8	9.8	17
Magnesium	2/2	34.6 - 223	15.1 - 21.5	129	129	223
Manganese	1/2	12.4 - 12.4	0.4 - 1.9	12.4	6.7	12.4
Mercury	1/2	0.13 - 0.13	0.07 - 0.21	0.13	0.09	0.13
Nickel	2/2	0.57 - 2.4	3.6 - 5.2	1.5	1.5	2.4
Potassium	2/2	36.6 - 123	84 - 119	79.8	79.8	123
Selenium	1/2	2.2 - 2.2	1.2 - 17.5	2.2	1.4	2.2
Silver	1/2	1.8 - 1.8	0.22 - 3.2	1.8	0.96	1.8
Vanadium	2/2	1.5 - 9.1	2 - 2.8	5.3	5.3	9.1
Zinc	2/2	8.8 - 50	0.84 - 1.2	29.4	29.4	50
NOTES:						
CRQL = Contract Required Quantitation Limits				ug/kg = microgram per kilogram		
PCBs = Polychlorinated Biphenyls				mg/kg = milligram per kilogram		

APPENDIX B

NAS JACKSONVILLE BACKGROUND VALUES

Table 4-1
Identification of Background Concentration - Surface Soil

Remedial Investigation and Feasibility Study, Operable Unit 1
Naval Air Station Jacksonville
Jacksonville, Florida

Parameter	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
Volatiles (µg/kg)				
Acetone	6/10	3 - 11	6.7	NA
Semivolatiles (µg/kg)				
Anthracene	1/10	37 - 37	37	NA
Benzo(a)Anthracene	2/10	27 - 250	139	NA
Benzo(a)Pyrene	3/10	29 - 150	71	NA
Benzo(b)Fluoranthene	3/10	26 - 330	140	NA
Benzo(g,h,i)Perylene	3/10	43 - 80	57.3	NA
Benzo(k)Fluoranthene	3/10	20 - 100	49.3	NA
Carbazole	1/10	46 - 46	46	NA
Chrysene	3/10	24 - 350	138	NA
Di-n-Butylphthalate	1/10	355 - 355	355	NA
Dibenz(a,h)Anthracene	2/10	18 - 31	24.5	NA
Fluoranthene	3/10	20 - 390	147	NA
Indeno(1,2,3-cd)Pyrene	3/10	41 - 88	57	NA
Phenanthrene	1/10	36 - 36	36	NA
Phenol	1/10	19 - 19	19	NA
Pyrene	3/10	28 - 430	163	NA
bis(2-Ethylhexyl)Phthalate	1/10	18 - 18	18	NA
Pesticides and PCBs (µg/kg)				
4,4-DDD	1/10	2.7 - 2.7	2.7	NA
4,4-DDE	4/10	1.8 - 12	4.6	NA
4,4-DDT	3/10	2.2 - 18	8.2	NA
Aroclor-1260	1/10	26 - 26	26	NA
Dieldrin	2/10	0.43 - 97	48.7	NA
alpha-Chlordane	1/10	0.25 - 0.25	0.25	NA
gamma-Chlordane	2/10	0.37 - 0.81	0.59	NA
Dioxins (µg/kg)				
1,2,3,4,6,7,8-HpCDD	1/3	0.0614 - 0.0614	0.0614	NA
OCDD	2/3	0.211 - 0.517	0.364	NA
Inorganics (mg/kg)				
Aluminum	10/10	31.8 - 1,710	670	1,340
Arsenic	7/10	0.29 - 0.6	0.4	0.8
Barium	10/10	1.1 - 12.7	5.6	11.2
Calcium	10/10	48.2 - 6,200	1,180	2,360
Chromium	7/10	1.5 - 4.6	3.3	6.6
Copper	3/10	1.7 - 5.2	2.9	5.8

See notes at end of table.

Table 4-1 (Continued)
Identification of Background Concentration - Surface Soil

Remedial Investigation and Feasibility Study, Operable Unit 1
 Naval Air Station Jacksonville
 Jacksonville, Florida

Parameter	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
Inorganics (mg/kg)				
Cyanide	3/7	0.18 - 0.22	0.2	0.4
Iron	10/10	124 - 928	426	852
Lead	10/10	1.2 - 26.6	7.2	14.4
Magnesium	9/10	15.9 - 154	49.9	99.8
Manganese	10/10	1.4 - 37.4	9	18
Nickel	5/10	2.8 - 14.7	5.5	11
Sodium	8/10	103 - 221	144	288
Thallium	1/10	0.21 - 0.21	0.21	0.42
Vanadium	8/9	0.58 - 4.6	1.9	3.8
Zinc	8/10	3.8 - 16.1	7.6	15.2
Radioisotopes (pCi/g)⁴				
Actinium-228	10/10	0.652 - 1.46	1	2
Bismuth-210	4/10	1.4 - 2.58	1.9	3.8
Bismuth-214	10/10	0.437 - 1.02	0.71	1.42
Cesium-137	8/10	0.0301 - 0.527	0.14	0.28
Lead-212	10/10	0.325 - 0.923	0.63	1.26
Lead-214	10/10	0.412 - 0.991	0.67	1.34
Potassium-40	10/10	0.8 - 4.335	2.6	5.2
Radium-223	4/10	0.709 - 1.56	1.1	2.2
Radium-224	7/10	0.82 - 2.14	1.5	3.0
Radium-228	10/10	0.652 - 1.46	1	2
Thallium-208	10/10	0.175 - 0.529	0.33	0.66
Thorium-231	5/10	0.069 - 0.145	0.12	0.24
Thorium-232	9/10	0.724 - 1.46	1.1	2.2
Thorium-234	2/10	0.595 - 4.24	2.4	4.8
Uranium-234	2/10	2.23 - 2.38	2.3	4.6
Uranium-238	2/10	2.23 - 2.38	2.3	4.6

¹ Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed. The samples are identified in Section 4.2.1.7 and Appendix P-4.

² The average of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

³ Two times the mean for inorganic analytes and radionuclides. Values of organic compounds detected in background surface soil samples are considered on a case-by-case basis in the evaluation of "site" samples.

⁴ The surface soil background screening concentration for radium-226, calculated from lead-214 concentrations, has been determined at 1.3 pCi/g.

Notes: $\mu\text{g/kg}$ = micrograms per kilogram.

NA = not applicable.

PCBs = polychlorinated biphenyls.

DDD = dichlorodiphenyldichloroethane.

DDE = dichlorodiphenyldichloroethane.

DDT = dichlorodiphenyltrichloroethane.

HpCDD = heptachlorodibenzo-p-dioxin.

OCDD = octachlorodibenzodioxin.

mg/kg = milligrams per kilogram.

pCi/g = picocuries per gram.

Table 4-2
Identification of Background Concentration - Subsurface Soil

Remedial Investigation and Feasibility Study, Operable Unit 1
Naval Air Station Jacksonville
Jacksonville, Florida

Parameter	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
<u>Volatiles (µg/kg)</u>				
Acetone	4/11	4 - 11	7.25	NA
<u>Semivolatiles (µg/kg)</u>				
Benzo(a)Pyrene	1/11	21 - 21	21	NA
Benzo(b)Fluoranthene	1/11	34 - 34	34	NA
Benzo(g,h,i)Perylene	1/11	29 - 29	29	NA
bis(2-Ethylhexyl)Phthalate	6/11	54 - 170	90.33	NA
Di-n-Butylphthalate	1/11	460 - 460	460	NA
Indeno(1,2,3-cd)Pyrene	1/11	23 - 23	23	NA
Phenol	4/11	20 - 24	21.5	NA
<u>Pesticides and PCBs (µg/kg)</u>				
4,4-DDE	1/11	0.29 - 0.29	0.29	NA
4,4-DDT	1/11	1.7 - 1.7	1.7	NA
alpha-Chlordane	2/11	0.37 - 0.45	0.41	NA
gamma-Chlordane	2/10	0.41 - 0.55	0.48	NA
Methoxychlor	1/11	1.2 - 1.2	1.2	NA
<u>Inorganics (mg/kg)</u>				
Aluminum	10/10	373 - 7,620	3,411.6	6,823.2
Arsenic	6/10	0.41 - 2.0	0.74	1.48
Barium	10/10	2.0 - 20.9	10.4	20.8
Beryllium	2/10	0.24 - 0.25	0.245	0.49
Calcium	10/10	44.8 - 1,200	334.15	668.3
Chromium	9/10	2.9 - 12.3	7.056	14.1
Iron	10/10	105 - 15600	2909.1	5818.2
Lead	10/10	1.5 - 5.6	3.23	6.46
Magnesium	8/10	104 - 700	250.125	500.25
Manganese	10/10	1.5 - 7.2	3.45	6.90
Potassium	3/10	187 - 252	225.33	450.67
Sodium	9/10	117 - 342	171.556	343.10
Zinc	9/10	4.1 - 12.8	7.244	14.49
<u>Radionuclides (pCi/g)⁴</u>				
Actinium-228	8/10	0.466 - 1.95	1.201	2.40
Bismuth-210	3/10	0.444 - 2.03	1.241	2.48
Bismuth-214	9/10	0.642 - 1.58	0.936	1.87
Lead-212	10/10	0.237 - 1.17	0.671	1.34
Lead-214	10/10	0.212 - 1.34	0.744	1.49
See notes at end of table.				

Table 4-2 (Continued)
Identification of Background Concentration - Subsurface Soil

Remedial Investigation and Feasibility Study, Operable Unit 1
 Naval Air Station Jacksonville
 Jacksonville, Florida

Parameter	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
Radionuclides (pCi/g)				
Potassium-40	8/10	2.12 - 8.76	5.57	11.14
Radium-223	3/10	0.286 - 1.56	0.9	1.80
Radium-224	6/10	1.13 - 2.31	1.585	3.17
Radium-228	8/10	0.429 - 1.95	1.216	2.43
Thallium-208	10/10	0.113 - 0.511	0.328	0.66
Thorium-231	6/10	0.044 - 0.240	0.145	0.29
Thorium-232	7/10	0.429 - 1.95	1.171	2.34
Thorium-234	5/10	2.96 - 4.53	3.484	6.98
Uranium-234	5/10	1.6 - 2.52	1.962	3.92
Uranium-238	5/10	1.6 - 2.52	1.962	3.92
Vanadium	9/10	0.99 - 16.7	7.288	14.58

¹ Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed. The samples are identified in Section 4.2.2.6 and Appendix P-4.

² The average of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

³ Two times the mean for inorganic analytes and radionuclides. Values of organic compounds detected in background surface soil samples are considered on a case-by-case basis in the evaluation of "site" samples.

⁴ The subsurface soil background screening concentration for radium-226, calculated from lead-214 concentrations, has been determined at 1.5 pCi/g.

Notes: $\mu\text{g/kg}$ = micrograms per kilogram.

NA = not applicable.

PCBs = polychlorinated biphenyls.

DDE = dichlorodiphenyldichloroethene.

DDT = dichlorodiphenyltrichloroethane.

mg/kg = milligrams per kilogram.

pCi/g = picocuries per gram.

Table 4-3
List of Soil Sampling Locations

Remedial Investigation and Feasibility Study, Operable Unit 1
Naval Air Station Jacksonville
Jacksonville, Florida

Soil Locations Inside Boundaries of Presumptive Remedy

SL001	SL027	SL045	SL099
SL002	SL028	SL046	SL100
SL003	SL029	SL047	SL101
SL009	SL030	SL048	SL102
SL010	SL032	SL049	SL103
SL011	SL033	SL050	SL27001
SL012	SL034	SL051	SL27002
SL013	SL035	SL052	SL27003
SL014	SL036	SL064	SL27004
SL016	SL037	SL072	SL27005
SL017	SL038	SL083	SL27006
SL018	SL039	SL088	SL27007
SL019	SL040	SL091	SL27008
SL022	SL041	SL093	SL27009
SL023	SL042	SL094	SL27010
SL024	SL043	SL097	SL27011
SL025	SL044	SL098	

Soil Locations Outside Boundaries of Presumptive Remedy

SL004	SL063	SL087	SL119
SL005	SL065	SL089	SL120
SL006	SL066	SL090	SL121
SL007	SL067	SL092	SL122
SL008	SL068	SL095	SL123
SL015	SL069	SL096	SL124
SL020	SL070	SL104	SL125
SL021	SL071	SL105	SL126
SL026	SL073	SL106	SL127
SL031	SL074	SL107	U1DSMW100
SL053	SL075	SL108	U1DSMW102
SL054	SL076	SL109	U1DSMW104
SL055	SL077	SL110	U1DSMW106
SL056	SL078	SL111	U1DSMW108
SL057	SL079	SL112	U1DSMW88
SL058	SL080	SL113	U1DSMW90
SL059	SL081	SL114	U1DSMW94
SL060	SL082	SL115	U1DSMW96
SL061	SL084	SL116	U1DSMW98
SL062	SL085	SL117	U1SSMW93
	SL086	SL118	U1SSMW97
			U1SSMW99

Table 4-4
Identification of Background Concentrations - Surface Water

Remedial Investigation and Feasibility Study, Operable Unit 1
Naval Air Station Jacksonville
Jacksonville, Florida

Parameter	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
<u>Inorganics (µg/l)</u>				
Arsenic	3/4	0.7 - 2.9	1.6	3.2
Barium	4/4	29.2 - 70.2	41.5	83
Calcium	4/4	7,320 - 34,200	19,555	39,110
Copper	4/4	2.1 - 7.1	3.8	7.6
Cyanide	3/4	0.6 - 3.1	1.5	3
Iron	4/4	362 - 1,920	1,218	2,436
Lead	4/4	0.8 - 8.7	3.3	6.6
Magnesium	4/4	1,800 - 5,090	3,063	6,126
Manganese	4/4	6.1 - 28.9	19.8	39.6
Potassium	4/4	453 - 1,530	896	1,792
Sodium	4/4	7,770 - 14,400	10,435	20,870
Vanadium	4/4	2 - 3.4	2.8	5.6
Zinc	4/4	14.8 - 38.7	23.2	46.4
<u>Radionuclides (pCi/l)</u>				
Bismuth-214	1/4	11.2 - 11.2	11.2	(*)
Thorium-234	1/4	158 - 158	158	(*)
<u>Dissolved Inorganics (µg/l)</u>				
Diss. Aluminum	4/4	32.5 - 301	211	422
Diss. Arsenic	4/4	0.9 - 2.7	1.5	3.0
Diss. Barium	4/4	28.8 - 48.1	35.3	70.6
Diss. Cadmium	1/4	0.73 - 0.73	0.73	1.46
Diss. Calcium	4/4	7,050 - 32,500	19,013	38,026
Diss. Copper	3/4	1.6 - 6.2	3.1	6.2
Diss. Iron	4/4	232 - 1,090	601	1,202
Diss. Lead	2/4	0.9 - 1.5	1.2	2.4
Diss. Magnesium	4/4	1,780 - 4,930	3,013	6,026
Diss. Manganese	4/4	6.8 - 29.2	17.8	35.6
Diss. Potassium	4/4	615 - 1,430	940	1,880
Diss. Sodium	4/4	7,760 - 14,300	10,410	20,820
Diss. Vanadium	1/4	4.3 - 4.3	4.3	8.6
Diss. Zinc	4/4	14.5 - 21.1	17.8	35.6

¹ Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed. The four samples used are taken from SW/SD58, SW/SD59, SW/SD60 and SW/SD62.

² The average of detected concentrations is the mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

³ Two times the mean for inorganic analytes and radiological parameters.

(*) Background screening concentrations for radionuclides were not developed for this set.

Notes: µg/l = micrograms per liter.
pCi/l = picocuries per liter.

Table 4-5
Identification of Background Concentrations - Sediment

Remedial Investigation and Feasibility Study, Operable Unit 1
Naval Air Station Jacksonville
Jacksonville, Florida

Chemical	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
<u>Volatiles (µg/kg)</u>				
2-Butanone	1/4	8 - 8	8	NA
Acetone	3/4	24 - 35	28.7	NA
<u>Semivolatiles (µg/kg)</u>				
Anthracene	1/4	84 - 84	84	NA
Benzo(a)Anthracene	1/4	470 - 470	470	NA
Benzo(a)Pyrene	1/4	480 - 480	480	NA
Benzo(b)Fluoranthene	1/4	540 - 540	540	NA
Benzo(g,h,i)Perylene	1/4	90 - 90	90	NA
Benzo(k)Fluoranthene	1/4	370 - 370	370	NA
Chrysene	1/4	540 - 540	540	NA
Dibenz(a,h)Anthracene	1/4	80 - 80	80	NA
Fluoranthene	1/4	1,300 - 1,300	1,300	NA
Indeno(1,2,3-cd)Pyrene	1/4	180 - 180	180	NA
Phenanthrene	1/4	590 - 590	590	NA
Pyrene	1/4	1,100 - 1,100	1,100	NA
<u>Pesticides and PCBs (µg/kg)</u>				
4,4-DDD	1/4	51 - 51	51	NA
4,4-DDE	2/4	3.1 - 170	86.6	NA
<u>Inorganics (mg/kg)</u>				
Aluminum	4/4	239 - 1,220	595	1,190
Antimony	1/4	4.6 - 4.6	4.6	9.2
Arsenic	3/4	0.2 - 0.97	0.63	1.26
Barium	4/4	2.2 - 9.6	4.9	9.8
Beryllium	1/4	0.24 - 0.24	0.24	0.48
Cadmium	1/4	0.3 - 0.3	0.3	0.6
Calcium	4/4	124 - 8,660	3,234	6,468
Chromium	3/4	0.73 - 2.9	1.9	3.8
Cobalt	1/4	1.9 - 1.9	1.9	3.8
Copper	3/4	2.6 - 4.2	3.5	7
Cyanide	3/4	0.06 - 0.11	0.08	0.16
Iron	4/4	560 - 2,290	1,150	2,300
Lead	4/4	2 - 12.3	7.2	14.4
Magnesium	4/4	25.2 - 110	65.5	131
Manganese	4/4	1.5 - 4.9	3.4	6.8
Mercury	1/4	0.05 - 0.05	0.05	0.1
See notes at end of table.				

Table 4-5 (Continued)
Identification of Background Concentrations - Sediment

Remedial Investigation and Feasibility Study, Operable Unit 1
 Naval Air Station Jacksonville
 Jacksonville, Florida

Chemical	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
<u>Inorganics (mg/kg)</u>				
Nickel	3/4	2.9 - 3.4	3.1	6.2
Potassium	1/4	109 - 109	109	218
Selenium	1/4	0.21 - 0.21	0.21	0.42
Sodium	3/4	239 - 260	249	498
Thallium	1/4	0.19 - 0.19	0.19	0.38
Vanadium	3/4	0.77 - 4.6	2.6	5.2
Zinc	4/4	2.6 - 18.8	9.2	18.4
<u>Radionuclides (pCi/g)</u>				
Actinium-228	4/4	0.64 - 0.887	0.8	1.6
Bismuth-212	2/4	1.06 - 1.34	1.2	2.4
Bismuth-214	4/4	0.418 - 0.668	0.54	1.08
Cesium-137	2/4	0.0953 - 0.14	0.12	0.24
Lead-212	4/4	0.378 - 0.816	0.52	1.04
Lead-214	1/4	0.447 - 0.447	0.45	0.90
Potassium-40	1/4	3.66 - 3.66	3.7	7.4
Thallium-208	4/4	0.188 - 0.286	0.24	0.48
Uranium-235	1/4	0.125 - 0.125	0.13	0.26

¹ Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed. The samples used are taken from SW/SD58, SW/SD59, SW/SD60, and SW/SD62.

² The average of detected concentrations is the mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

³ Two times the mean for inorganic analytes and radiological parameters.

Notes: $\mu\text{g/kg}$ = micrograms per kilogram.

NA = not applicable.

PCBs = polychlorinated biphenyls.

DDD = dichlorodiphenyldichloroethane.

DDE = dichlorodiphenyldichloroethene.

mg/kg = milligrams per kilogram.

pCi/g = picocuries per gram.

Table 4-6
Identification of Background Screening Concentration - Groundwater

Remedial Investigation and Feasibility Study, Operable Unit 1
Naval Air Station Jacksonville
Jacksonville, Florida

Parameter	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
<u>Volatiles (µg/l)</u>				
Carbon Disulfide	5/42	1 - 7	3	NA
Chloroform	1/42	2 - 2	2	NA
Chloromethane	2/42	1 - 3	2	NA
Xylene (total)	1/42	1 - 1	1	NA
<u>Semivolatiles (µg/l)</u>				
Diethylphthalate	1/42	3 - 3	3	NA
Phenol	1/42	1 - 1	1	NA
bis(2-Ethylhexyl)Phthalate	18/42	0.6 - 64	6.1	NA
<u>Pesticides and PCBs (µg/l)</u>				
4,4'-DDE	1/42	0.006 - 0.006	0.01	NA
Dieldrin	1/42	0.016 - 0.016	0.02	NA
<u>Inorganics (µg/l)</u>				
Aluminum	42/42	146 - 451,000	73,659	147,318
Antimony	2/40	20.2 - 22.7	21.5	43
Arsenic	34/42	1.05 - 14.2	6.6	13.2
Barium	42/42	19.3 - 3,160	308	616
Beryllium	30/42	0.335 - 30	4.1	8.2
Cadmium	12/42	0.78 - 8.8	4.1	8.2
Calcium	42/42	2,300 - 163,000	29,533	59,066
Chromium	36/42	2.35 - 542	104	208
Cobalt	26/42	3.5 - 57.8	11.3	22.6
Copper	30/42	3.2 - 78.5	20.2	40.4
Cyanide	4/42	1.8 - 2.5	2.2	4.4
Iron	42/42	255 - 187,000	34,146	68,292
Lead	36/42	0.5 - 136	22.9	45.8
Magnesium	42/42	3,340 - 36,700	9,658	19,316
Manganese	42/42	7.4 - 1,240	102	204
Mercury	18/42	0.14 - 2.1	0.49	0.98
Nickel	21/42	9.6 - 174	37.4	74.8
Potassium	41/42	902 - 17,700	4,519	9,038
Selenium	9/42	0.56 - 47.9	6.9	13.8
Silver	2/42	4.2 - 5.1	4.7	9.4
Sodium	42/42	790 - 29,000	12,313	24,626
Vanadium	37/42	2.625 - 728.5	147	294
<u>Inorganics (µg/l)</u>				
Zinc	42/42	6.6 - 261	86.6	173.2

See notes at end of table.

Table 4-6 (Continued)
Identification of Background Screening Concentration - Groundwater

Remedial Investigation and Feasibility Study, Operable Unit 1
Naval Air Station Jacksonville
Jacksonville, Florida

Parameter	Frequency of Detection ¹	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³
Radioisotope (µg/l)				
Actinium-228	2/42	* 11.7 - 21.8	16.8	33.6
Bismuth-214	3/42	* 5.3 - 11.6	7.5	15
Lead-214	3/42	* 6.7 - 18.1	13.3	26.6
Potassium-40	3/42	60.1 - 138	92.6	185.6
Radium-224	6/42	* 54.5 - 105	88.4	176.8
Thallium-208	3/42	* 3.7 - 7.3	5.7	11.4
Diss. Aluminum	34/42	8 - 74,200	8,905	NA
Diss. Antimony	9/42	12.8 - * 30.05	19.6	NA
Diss. Arsenic	16/42	* 0.6 - 6.6	3.2	NA
Diss. Barium	42/42	* 9.9 - * 250	64.1	NA
Diss. Beryllium	10/42	* 0.43 - 3.2	1.3	NA
Diss. Cadmium	4/42	1 - 6.2	3.7	NA
Diss. Calcium	42/42	1,130 - * 99,300	23,232	NA
Diss. Chromium	16/42	2.5 - 75.8	23.7	NA
Diss. Cobalt	8/42	* 2.75 - * 6.4	4.8	NA
Diss. Copper	22/42	1.1 - 12.7	5.3	NA
Diss. Iron	41/42	11.8 - * 27,800	4,509	NA
Diss. Lead	21/42	0.6 - 18.9	4.1	NA
Diss. Magnesium	42/42	1,030 - * 15,800	4,773	NA
Diss. Manganese	41/42	* 2.65 - 134	35.4	NA
Diss. Mercury	1/42	0.1 - 0.1	0.1	NA
Diss. Nickel	4/42	* 10.3 - 19.5	13.2	NA
Diss. Potassium	42/42	585 - * 5,770	1,912	NA
Diss. Selenium	2/42	1.2 - 4.1	2.7	NA
Diss. Sodium	42/42	2,070 - 31,200	12,410	NA
Diss. Thallium	1/42	1 - 1	1	NA
Diss. Vanadium	24/42	* 2.625 - * 105.55	25.6	NA
Diss. Zinc	39/42	6.2 - 134	35.1	NA

¹ Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed. The samples analyzed are identified in Table R-4.7.

² The mean of detected concentrations is the mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

³ Two times the mean for inorganic analytes.

⁴ The groundwater background screening concentration for radium-226, calculated from lead-214 concentrations, has been determined at 26.6 pCi/l.

* Value is the average of a sample and its duplicate.

Notes: µg/l = micrograms per liter.

NA = not applicable.

PCBs = polychlorinated biphenyls.

DDE = dichlorodiphenyldichloroethene.

APPENDIX C

FIELD SOPs AND FIELD FORMS

FC 1000. CLEANING / DECONTAMINATION PROCEDURES

1. PERFORMANCE CRITERIA

- 1.1. The cleaning/decontamination procedures must ensure that all equipment that contacts a sample during sample collection is free from the analytes of interest and constituents that would interfere with the analytes of interest.
- 1.2. The detergents and other cleaning supplies cannot contribute analytes of interest or interfering constituents unless these are effectively removed during a subsequent step in the cleaning procedure.
- 1.3. The effectiveness of any cleaning procedure (including all cleaning reagents) must be supported by equipment blanks with reported non-detected values.

The cleaning procedures outlined in this SOP are designed to meet the above-mentioned performance criteria. Alternative cleaning reagents or procedures may be used. However, the organization must be prepared to demonstrate through documentation (i.e., company-written protocols and analytical records) and historical data (i.e., absence of analytes of interest in equipment blanks) that it consistently meets these performance criteria. Field quality control measures (see FQ 1210) must support the use of alternative reagents or procedures.

FC 1001. *Cleaning Reagents*

Recommendations for the types and grades of various cleaning supplies are outlined below. The recommended reagent types or grades were selected to ensure that the cleaned equipment is free from any detectable contamination.

1. DETERGENTS: Use Luminex (or a non-phosphate solvent based equivalent), Liqui-Nox (or a non-phosphate equivalent) or Alconox (or equivalent). EPA recommends Luminex (or equivalent) since solvent rinses can be eliminated from the cleaning process. Liquinox (or equivalent) may be substituted (solvent rinses, when applicable, must be performed), and Alconox (or equivalent) may be substituted if the sampling equipment will not be used to collect phosphorus or phosphorus-containing compounds.

2. SOLVENTS

Note: If the detergent Luminex (or equivalent) is used, solvent rinses are not required.

- 2.1. Use pesticide grade isopropanol as the rinse solvent in routine equipment cleaning procedures. This grade of alcohol must be purchased from a laboratory supply vendor.
- 2.2. Other solvents, such as acetone or methanol, may be used as the final rinse solvent if they are pesticide grade. However, methanol is more toxic to the environment and acetone may be an analyte of interest for volatile organics.
 - 2.2.1. **Do not use** acetone if volatile organics are of interest.
- 2.3. Properly dispose of all wastes according to applicable regulations. Containerize all solvents (including rinsates) for on-site remediation or off-site disposal, as required.
- 2.4. Pre-clean equipment that is heavily contaminated (see FC 1120, section 3) with organic analytes with reagent grade acetone and hexane or other suitable solvents.
- 2.5. Use pesticide grade methylene chloride when cleaning sample containers.

2.6. Store all solvents away from potential sources of contamination (gas, copier supplies, etc.).

3. ANALYTE-FREE WATER SOURCES

3.1. Analyte-free water is water in which all analytes of interest and all interferences are below method detection limits.

3.2. Maintain documentation (such as results from equipment blanks) to demonstrate the reliability and purity of analyte-free water source(s).

3.3. The source of the water must meet the requirements of the analytical method and must be free from the analytes of interest. In general, the following water types are associated with specific analyte groups:

- Milli-Q (or equivalent polished water): suitable for all analyses.
- Organic-free: suitable for volatile and extractable organics.
- Deionized water: not suitable for volatile and extractable organics if the analytes of interest are present in concentrations that affect the result.
- Distilled water: not suitable for volatile and extractable organics, metals or ultra-trace metals.

3.4. Use analyte-free water for blank preparation and the final decontamination water rinse.

3.5. In order to minimize long-term storage and potential leaching problems, obtain or purchase analyte-free water just prior to the sampling event. If obtained from a source (such as a laboratory), fill the transport containers and use the contents for a single sampling event. Empty the transport container(s) at the end of the sampling event.

3.6. Discard any analyte-free water that is transferred to a dispensing container (such as a wash bottle) at the end of each sampling day.

4. ACIDS

4.1. Reagent Grade Nitric Acid: 10 - 15% (one volume concentrated nitric acid and five volumes deionized water).

4.1.1. Use for the acid rinse unless nitrogen components (e.g., nitrate, nitrite, etc.) are to be sampled.

4.1.2. If sampling for ultra-trace levels of metals, use an ultra-pure grade acid.

4.2. Reagent Grade Hydrochloric Acid: 10% hydrochloric acid (one volume concentrated hydrochloric and three volumes deionized water).

4.2.1. Use when nitrogen components are to be sampled.

4.3. If samples for both metals and the nitrogen-containing components (see FC 1001, section 4.1.1 above) are collected with the equipment, use the hydrochloric acid rinse, or thoroughly rinse with hydrochloric acid after a nitric acid rinse.

4.4. If sampling for ultra trace levels of metals, use an ultra-pure grade acid.

4.5. Freshly prepared acid solutions may be recycled during the sampling event or cleaning process. Dispose appropriately at the end of the sampling event, cleaning process or if acid is discolored or appears otherwise contaminated (e.g., floating particulates).

4.5.1. Transport only the quantity necessary to complete the sampling event.

- 4.6. Dispose of any unused acids according to FDEP and local ordinances.

FC 1002. *Reagent Storage Containers*

The contents of all containers must be clearly marked.

1. DETERGENTS: Store in the original container or in a high density polyethylene (HDPE) or polypropylene (PP) container.
2. SOLVENTS
 - 2.1. Store solvents to be used for cleaning or decontamination in the original container until use in the field. If transferred to another container for field use, the container must be either glass or Teflon.
 - 2.2. Use dispensing containers constructed of glass, Teflon, or stainless steel. Note: if stainless steel sprayers are used, any components (including gaskets and transfer lines) that contact the solvents must be constructed of inert materials.
3. ANALYTE-FREE WATER: Transport in containers appropriate to the type of water to be stored. If the water is commercially purchased (e.g., grocery store), use the original containers when transporting the water to the field. Containers made of glass, Teflon, polypropylene, or Polyethylene (PE) are acceptable.
 - 3.1. Use glass, Teflon, polypropylene or PE to transport organic-free sources of water on-site.
 - 3.2. Dispense water from containers made of glass, Teflon, PE or polypropylene.
 - 3.3. Do not store water in transport containers for more than three days before beginning a sampling event.
 - 3.4. Store and dispense acids using containers made of glass, Teflon, PE or polypropylene.

FC 1003. *General Requirements*

1. Before using any equipment, clean/decontaminate all sampling equipment (pumps, tubing, lanyards, split spoons, etc.) that are exposed to the sample.
 - 1.1. Before installing, clean (or obtain as certified precleaned) all equipment that is dedicated to a single sampling point and remains in contact with the sample medium (e.g., permanently installed groundwater pump (see FS 2220, section 3.3.4)).
 - 1.2. Clean this equipment any time it is removed for maintenance or repair.
 - 1.3. Replace dedicated tubing if discolored or damaged.
2. Clean all equipment in a designated area having a controlled environment (house, laboratory, or base of field operations) and transport to the field precleaned and ready to use, unless otherwise justified.
3. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.
4. Whenever possible, transport sufficient clean equipment to the field so that an entire sampling event can be conducted without the need for cleaning equipment in the field.

5. Segregate equipment that is only used once (i.e., not cleaned in the field) from clean equipment and return to the in-house cleaning facility to be cleaned in a controlled environment.
6. Protect decontaminated field equipment (including well sounders) from environmental contamination by securely wrapping and sealing with one of the following:
 - 6.1. Aluminum foil (commercial grade is acceptable);
 - 6.2. Untreated butcher paper; or
 - 6.3. Clean, untreated, disposable plastic bags. Plastic bags may be used:
 - For all analyte groups except volatile and extractable organics;
 - For volatile and extractable organics, if the equipment is first wrapped in foil or butcher paper or if the equipment is completely dry.
7. Containerize all solvent rinsing wastes, detergent wastes and other chemical wastes requiring off-site or regulated disposal. Dispose of all wastes in conformance with applicable regulations.

FC 1100. Cleaning Sample Collection Equipment

FC 1110. ON-SITE/IN-FIELD CLEANING

1. Cleaning equipment on-site is not recommended because:
 - 1.1. Environmental conditions cannot be controlled.
 - 1.2. Wastes (solvents and acids) must be containerized for proper disposal.
2. If performed, follow the appropriate cleaning procedure as outlined in FC 1130. Ambient temperature water may be substituted in the hot, sudsy water bath, and hot water rinses.

Note: Properly dispose of all solvents and acids.

3. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.

FC 1120. HEAVILY CONTAMINATED EQUIPMENT

In order to avoid contaminating other samples, isolate heavily contaminated equipment from other equipment and thoroughly decontaminate the equipment before further use. Equipment is considered heavily contaminated if it:

- Has been used to collect samples from a source known to contain significantly higher levels than background;
 - Has been used to collect free product; or
 - Has been used to collect industrial products (e.g., pesticides or solvents) or their by-products.
1. Cleaning heavily contaminated equipment in the field is not recommended.
 2. ON-SITE PROCEDURES
 - 2.1. Protect all other equipment, personnel and samples from exposure by isolating the equipment immediately after use.

- 2.2. At a minimum, place the equipment in a tightly sealed untreated plastic bag.
 - 2.3. Do not store or ship the contaminated equipment next to clean, decontaminated equipment, unused sample containers, or filled sample containers.
 - 2.4. Transport the equipment back to the base of operations for thorough decontamination.
 - 2.5. If cleaning must occur in the field, and in order to document the effectiveness of the procedure, collect and analyze blanks on the cleaned equipment (see FQ 1000).
3. CLEANING PROCEDURES
- 3.1. If organic contamination cannot be readily removed with scrubbing and a detergent solution, prerinse equipment by thoroughly rinsing or soaking the equipment in acetone.
 - 3.1.1. Do not use solvent soaks or rinses if the material is clear acrylic.
 - 3.1.2. Use hexane only if preceded and followed by acetone.
 - 3.2. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with routine cleaning procedures.
 - 3.3. After the solvent rinses (and/or steam cleaning), use the appropriate cleaning procedure (see FC 1130).
 - 3.3.1. Scrub, rather than soak all equipment with sudsy water.
 - 3.3.2. If high levels of metals are suspected and the equipment cannot be cleaned without acid rinsing, soak the equipment in the appropriate acid. Do not use stainless steel equipment when heavy metal contamination is suspected or present, since stainless steel cannot be exposed to prolonged acid soaks.
 - 3.4. If the field equipment cannot be cleaned utilizing these procedures, discard unless further cleaning with stronger solvents and/or oxidizing solutions is effective as evidenced by visual observation and blanks.
 - 3.5. Clearly mark or disable all discarded equipment to discourage use.

FC 1130. GENERAL CLEANING

Follow these procedures when cleaning equipment under controlled conditions. See FC 1110 for modifications if cleaning is performed on-site. Check manufacturer's instructions for cleaning restrictions and/or recommendations.

FC 1131. *Procedure for Teflon, Stainless Steel and Glass Sampling Equipment*

This procedure must be used when sampling for **ALL** analyte groups: extractable organics, metals, nutrients, etc. or if a single decontamination protocol is desired to clean all Teflon, stainless steel and glass equipment.

1. Rinse equipment with hot tap water.
2. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent - see FC 1001, section 1).
3. If necessary, use a brush to remove particulate matter or surface film.
4. Rinse thoroughly with hot tap water.

5. If samples for trace metals or inorganic analytes will be collected with the equipment and the equipment **is not** stainless steel, thoroughly rinse (wet all surfaces) with the appropriate acid solution (see FC 1001, section 4).
6. Rinse thoroughly with analyte-free water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water.
7. If samples for volatile or extractable organics will be collected, rinse with isopropanol. Wet equipment surfaces thoroughly with free-flowing solvent. Rinse thoroughly with analyte-free water (see FC 1001, section 3).
8. Allow to air dry. Wrap and seal according to FC 1003, section 6 as soon as the equipment is air-dried.
9. If isopropanol is used, the equipment may be air-dried without the final analyte-free water rinse (see FC 1131, section 8 above); however, **the equipment must be completely dry before wrapping or use.**
10. Wrap clean sampling equipment according to the procedure described in FC 1003, section 6.

FC 1132. *General Cleaning Procedure for Plastic Sampling Equipment*

1. Rinse equipment with hot tap water.
2. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent - see FC 1001, section 1).
3. If necessary, use a brush to remove particulate matter or surface film.
4. Rinse thoroughly with hot tap water.
5. Thoroughly rinse (wet all surfaces) with the appropriate acid solution (see FC 1001, section 4).
6. Rinse thoroughly with analyte-free water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water. Allow to air dry as long as possible.
7. Wrap clean sampling equipment according to the procedure described in FC 1003, section 6.

FC 1133. *Cleaning Procedure by Analyte Group*

See Table FC 1000-1 for the procedures to be used to decontaminate equipment based on construction of sampling equipment, and analyte groups to be sampled.

FC 1140. **AUTOMATIC SAMPLERS, SAMPLING TRAINS AND BOTTLES**

1. When automatic samplers are deployed for extended time periods, clean the sampler using the following procedures when routine maintenance is performed. Inspect deployed samplers prior to each use. At a minimum, change the tubing if it has become discolored or has lost elasticity (FC 1140, section 2.3 below).
2. Clean all automatic samplers (such as ISCO) as follows:
 - 2.1. Wash the exterior and accessible interior portions of the automatic samplers (excluding the waterproof timing mechanisms) with laboratory detergent (see FC 1001, section 1) and rinse with tap water.

- 2.2. Clean the face of the timing case mechanisms with a clean, damp cloth.
- 2.3. Check all tubing (sample intake and pump tubing). Change the tubing every six months (if used frequently) or if it has become discolored (i.e., affected by mold and algae) or if it has lost its elasticity.
- 2.4. See FC 1160, section 4 for the procedures associated with cleaning the tubing in the pump head.
3. AUTOMATIC SAMPLER ROTARY FUNNEL AND DISTRIBUTOR
 - 3.1. Clean with hot sudsy water and a brush (see FC 1001, section 1 for appropriate detergent type).
 - 3.2. Rinse thoroughly with analyte-free water.
 - 3.3. Air dry.
 - 3.4. Replace in sampler.
4. SAMPLER METAL TUBE: Clean as outlined in FC 1160, section 5.
5. REUSABLE GLASS COMPOSITE SAMPLE CONTAINERS
 - 5.1. If containers are used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the container several times with reagent-grade acetone before the detergent wash. If material cannot be removed with acetone, discard the container.
 - 5.2. Wash containers following the procedure outlined in FC 1131 above. End with a final solvent rinse if organics are to be sampled.
 - 5.3. Invert containers to drain and air dry for at least 24 hours.
 - 5.4. Cap with aluminum foil, Teflon film or the decontaminated Teflon-lined lid.
 - 5.5. After use, rinse with water in the field, seal with aluminum foil to keep the interior of the container wet, and return to the laboratory or base of operations.
 - 5.6. **Do not recycle or reuse containers if:**
 - 5.6.1. They were used to collect in-process (i.e., untreated or partially treated) wastewater samples at industrial facilities;
 - 5.6.2. A visible film, scale or discoloration remains in the container after the cleaning procedures have been used; or
 - 5.6.3. The containers were used to collect samples at pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds. Such containers must be properly disposed of (preferably at the facility) at the conclusion of the sampling activities.
 - 5.6.4. If the containers described above are reused, check no less than 10% of the cleaned containers for the analytes of interest **before** use. If found to be contaminated, (i.e., constituents of interest are found at method detection levels or higher), then **discard the containers**.
6. REUSABLE PLASTIC COMPOSITE SAMPLE CONTAINERS
 - 6.1. Follow FC 1132.

- 6.2. Inspect the containers. Determine if the containers can be reused by the criteria in FC 1140, section 5 above.
7. GLASS SEQUENTIAL SAMPLE BOTTLES FOR AUTOMATIC SAMPLER BASED FOR SEQUENTIAL MODE
 - 7.1. Clean glass sequential sample bottles to be used for collecting inorganic samples by using a laboratory dishwasher (see FC 1140, sections 7.1.1 through 7.1.3 below) or manually following the procedures in FC 1131.
 - 7.1.1. Rinse with appropriate acid solution (see FC 1001, section 4).
 - 7.1.2. Rinse thoroughly with tap water.
 - 7.1.3. Wash in dishwasher at wash cycle, using laboratory detergent cycle, followed by tap and analyte-free water rinse cycles.
 - 7.2. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.
 - 7.3. Rinse bottles in the field with water as soon as possible after sampling event.
8. Glass Sequential Sample Bottles (Automatic Sampler based for Sequential Mode) to be used for Collecting Samples for Organic Compounds
 - 8.1. Use cleaning procedures outlined in FC 1131. Allow containers to thoroughly air dry before use.
 - 8.2. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.
9. BOTTLE SIPHONS USED TO TRANSFER SAMPLES FROM COMPOSITE CONTAINERS
 - 9.1. Rinse tubing with solvent and dry overnight in a drying oven.
 - 9.2. Cap ends with aluminum foil and/or Teflon film for storage.
 - 9.3. Seal in plastic for storage and transport.
 - 9.4. Flush siphon thoroughly with sample before use.
10. REUSABLE TEFLON COMPOSITE MIXER RODS
 - 10.1. Follow procedures outlined in FC 1131.
 - 10.2. Wrap in aluminum foil for storage.

FC 1150. FILTRATION EQUIPMENT

1. Dissolved Constituents using in-line, Molded and Disposable Filter Units
 - 1.1. Peristaltic Pump
 - 1.1.1. Clean the pump following procedures in FC 1170, section 2.2.
 - 1.1.2. Clean the pump head tubing following FC 1160, section 4.
 - 1.1.3. If Teflon tubing is used, clean following the procedures in FC 1160, section 3.
 - 1.1.4. Clean other tubing types such as polyethylene according to the appropriate procedures listed in FC 1160, section 7.
 - 1.2. Other Equipment Types (e.g., pressurized Teflon bailer)

- 1.2.1. Follow the appropriate cleaning regimen specified in FC 1131 through FC 1132 for other types of equipment that utilize in-line, molded and disposable filters.
2. Dissolved Constituents using Non-disposable Filtration Units (e.g., syringes, "tripod assembly")
 - 2.1. Stainless Steel or Glass Units
 - 2.1.1. Follow FC 1131, assembling and applying pressure to the apparatus after each rinse step (water and acid) to drive rinsing solution through the porous filter holder in the bottom of the apparatus.
 - 2.1.2. Remove and clean any transfer tubing according to the appropriate cleaning procedures (see FC 1160).
 - 2.1.3. Assemble the unit and cap both the pressure inlet and sample discharge lines (or whole unit if a syringe) with aluminum foil to prevent contamination during storage.
 - 2.1.4. If the unit will **not** be used to filter volatile or extractable organics, seal the unit in an untreated plastic bag to prevent contamination.
 - 2.2. Reusable In-Line Filter Holders
 - 2.2.1. Clean, using FC 1131, (if Teflon, glass or stainless steel) or FC 1132 (if plastic) assembling and applying pressure to the apparatus after each rinse step (water and acid) to drive rinsing solution through the porous filter holder in the bottom of the apparatus.
 - 2.2.2. Assemble the unit and wrap with aluminum foil to prevent contamination during storage.
 - 2.2.3. If the unit will **not** be used to filter volatile or extractable organics, seal the unit in an untreated plastic bag to prevent contamination.
3. FILTERS
 - 3.1. Do not clean filters. Instructions for rinsing the filters prior to use are discussed in the applicable sampling SOPs (FS 2000 - FS 8000).

FC 1160. SAMPLE TUBING DECONTAMINATION

1. Check tubing:
 - 1.1. For discoloration: Remove discolored tubing from use until it can be cleaned. If the discoloration cannot be removed, discard the tubing.
 - 1.2. For elasticity (if used in a peristaltic-type pump): Discard any tubing that has lost its elasticity.
2. Transport all tubing to the field in precut, **precleaned** sections.
3. TEFLON, POLYETHYLENE AND POLYPROPYLENE TUBING
 - 3.1. New Tubing: Follow this procedure unless the manufacturer/supplier provides certification that the tubing is clean.
 - 3.1.1. Teflon
 - 3.1.1.1. Rinse outside of tubing with pesticide-grade solvent (see FC 1001, section 2).

- 3.1.1.2. Flush inside of tubing with pesticide-grade solvent.
- 3.1.1.3. Dry overnight in drying oven or equivalent (zero air, nitrogen, etc.).

3.1.2. Polyethylene and Polypropylene

- 3.1.2.1. Clean the exterior and interior of the tubing by soaking in hot, sudsy water.
- 3.1.2.2. Thoroughly rinse the exterior and interior of the tubing with tap water, followed by analyte-free water.

3.2. Reused Tubing

Use the following procedure for in-lab cleaning. **Field cleaning is not recommended:**

- 3.2.1. Clean the exterior of the tubing by soaking in hot, sudsy water (see FC 1001, section 1) in a stainless steel sink (or equivalent non-contaminating material). Use a brush to remove any particulates, if necessary.
- 3.2.2. Use a small bottle brush and clean the inside of the tubing ends where the barbs are to be inserted or cut 1-2 inches from the ends of the tubing after cleaning.
- 3.2.3. Rinse tubing exterior and ends liberally with tap water.
- 3.2.4. Rinse tubing surfaces and ends with the appropriate acid solution (see FC 1001, section 4), tap water, isopropanol (see FC 1001, section 2), and finally analyte-free water.
 - 3.2.4.1. Note: Eliminate the isopropanol rinse for polyethylene or polypropylene tubing.
- 3.2.5. Place tubing on fresh aluminum foil or clean polyethylene sheeting. Connect all of the precut lengths of tubing with Teflon inserts or barbs.
- 3.2.6. Cleaning configuration:
 - 3.2.6.1. Place cleaning reagents: [sudsy water (see FC 1001, section 1); acid (see FC 1001, section 4); isopropanol (see FC 1001, section 2)] in an appropriately cleaned container (2-liter glass jar is recommended).
 - 3.2.6.2. Place one end of the Teflon tubing into the cleaning solution.
 - 3.2.6.3. Attach the other end of the Teflon tubing set to the influent end of a pump.
 - 3.2.6.4. Recycle the effluent from the pump by connecting a length of Teflon tubing from the effluent to the glass jar with the cleaning reagents.
 - 3.2.6.5. Recycling as described above may be done for all reagents listed in FC 1160, section 3.2.6.1 above, **except** the final isopropanol rinse and the final analyte-free water rinse. Disconnect the tubing between the effluent end of the pump and the jar of cleaning reagents.
 - 3.2.6.6. Containerize isopropanol in a waste container for proper disposal.
 - 3.2.6.7. Analyte-free water may be discarded down the drain.
- 3.2.7. Using the above configuration described in FS 1160, section 3.2.6 above:
 - 3.2.7.1. Pump hot, sudsy water through the connected lengths. Allow the pump to run long enough to pump at least three complete tubing volumes through the tubing set.

3.2.7.2. Using the same procedure, successively pump tap water, the acid solution(s), tap water, isopropanol, and finally analyte-free water through the system.

3.2.7.3. Leave the Teflon inserts or barbs between the precut lengths and cap or connect the remaining ends.

3.2.8. After the interior has been cleaned as described in FC 1160, section 3.2.7 above, rinse the exterior of the tubing with analyte-free water.

3.2.9. Wrap the connected lengths in aluminum foil or untreated butcher paper and store in a clean, dry area until use.

4. Flexible Tubing used in Pump Heads of Automatic Samplers and other Peristaltic Pumps

Replace tubing after each sampling point if samples are collected through the tubing. Unless the pump is deployed to collect samples from the same location over a long period of time, remove and wash the tubing after each sampling event (see FC 1140, section 1).

4.1. Flush tubing with hot tap water then sudsy water (see FC 1001, section 1).

4.2. Rinse thoroughly with hot tap water.

4.3. Rinse thoroughly with analyte-free water.

4.4. If used to collect metals samples, flush the tubing with an appropriate acid solution (see FC 1001, section 4), followed by thorough rinsing with analyte-free water. If used to collect both metals and nitrogen components use hydrochloric acid (see FC 1001, section 4.1.1).

4.5. Install tubing in peristaltic pump or automatic sampler.

4.6. Cap both ends with aluminum foil or equivalent.

Note: Change tubing at specified frequencies as part of routine preventative maintenance.

5. STAINLESS STEEL TUBING

Clean the exterior and interior of stainless steel tubing as follows:

5.1. Using sudsy water (see FC 1001, section 1), scrub the interior and exterior surfaces.

5.2. Rinse with hot tap water.

5.3. Rinse with analyte-free water.

5.4. If volatile or extractable organics are to be sampled, rinse all surfaces with isopropanol (see FC 1001, section 2). Use enough solvent to wet all surfaces with free flowing solvent.

5.5. Allow to air dry or thoroughly rinse with analyte-free water.

6. GLASS TUBING

6.1. Use new glass tubing.

6.2. If volatile or extractable organics are to be sampled, rinse with isopropanol (see FC 1001, section 2).

6.3. Air dry for at least 24 hours.

6.4. Wrap in aluminum foil or untreated butcher paper to prevent contamination during storage.

6.5. Discard tubing after use.

7. MISCELLANEOUS NON-INERT TUBING TYPES (TYGON, RUBBER, PVC, ETC.)

7.1. New Tubing

7.1.1. As a general rule, new tubing may be used without preliminary cleaning.

7.1.2. Protect new tubing from potential environmental contamination by wrapping in aluminum foil and sealing in untreated plastic bags or keep in the original sealed packaging until use.

7.1.3. If new tubing is exposed to potential contamination, rinse the exterior and interior tubing surfaces with hot tap water followed by a thorough rinse with analyte-free water.

7.1.4. If new tubing is to be used to collect samples, thoroughly rinse the tubing with sample water (i.e., pump sample water through the tubing) before collecting samples.

7.2. Reused Tubing

7.2.1. Flush tubing with sudsy solution of hot tap water and laboratory detergent (see FC 1001, section 1).

7.2.2. Rinse exterior and interior thoroughly with hot tap water.

7.2.3. Rinse exterior and interior thoroughly with analyte-free water.

7.2.4. If used to collect only metals samples, flush the tubing with nitric acid (see FC 1001, section 4.1), followed by a thorough rinse with analyte-free water.

7.2.5. If used to collect metals and nitrogen-containing compounds, see FC 1001, section 4.3.

7.2.6. Cap ends in aluminum foil and store in clean, untreated plastic bags to prevent contamination during storage and transport.

FC 1170. PUMPS

1. SUBMERSIBLE PUMPS

1.1. Pumps used for Purging and Sampling Metals and/or Volatile and Extractable Organics

1.1.1. Construction of pump body and internal mechanisms (bladders, impellers, etc.), including seals and connections, must follow Tables FS 1000-1, FS 1000-2 and FS 1000-3.

1.1.2. Tubing material must follow Tables FS 1000-1, FS 1000-2 and FS 1000-3.

1.1.3. Clean pump exterior following FC 1132. Note: omit the solvent rinse if the pump body is constructed of plastic (e.g., ABS, PVC, etc.).

1.1.4. Clean the pump internal cavity and mechanism as follows:

1.1.4.1. If used only for purging, thoroughly flush the pump with water before purging the next well.

1.1.4.2. When used for purging and sampling, completely disassemble the pump (if practical) and decontaminate between each well.

1.1.4.3. When used for purging and sampling and the pump cannot be (practicably) disassembled, then clean the internal cavity/mechanism by pumping

several gallons of sudsy water (see FC 1001, section 1), followed by several gallons of tap water, and finally, several gallons of analyte-free water.

1.1.4.4. If multiple sampling points are located in an area that is not accessible by a vehicle, and it is difficult to return to the vehicle for cleaning or to transport all cleaning materials to the staging location, at a minimum thoroughly rinse the pump with water.

1.1.5. Refer to FC 1160, section 3 to clean Teflon tubing.

1.1.6. Refer to FC 1160, section 5 for stainless steel tubing.

1.1.7. Clean other types of tubing according to FC 1160, sections 6 and 7.

1.2. Pumps used for Purging and Sampling all Analytes except Metals, Volatile and Extractable Organics

1.2.1. Pump construction: no restrictions.

1.2.2. Pump tubing material: no restrictions.

1.2.3. Scrub the exterior of the pump with appropriate metal-free, phosphate-free or ammonia-free detergent solution.

1.2.4. Rinse the exterior with tap water and analyte-free water.

1.2.5. Rinse the interior of the pump and tubing by pumping tap or analyte-free water through the system using a clean bucket or drum.

2. ABOVE-GROUND PUMPS USED FOR PURGING AND SAMPLING

2.1. Pumps used only for Purging

2.1.1. The exterior of the pump must be free of oil and grease.

2.1.2. Select tubing according to Tables FS 1000-1, FS 1000-2 and FS 1000-3.

2.1.3. Clean the tubing that contacts the formation water according to the appropriate protocol for construction materials specified in FC 1160.

2.2. Pumps used for Sampling

2.2.1. Clean the exterior of the pump with a detergent solution followed by a tap water rinse. Use clean cloths or unbleached paper towels that have been moistened with the appropriate solution to wipe down the pump.

2.2.2. Select tubing according to Tables FS 1000-1, FS 1000-2 and FS 1000-3.

2.2.3. Clean the tubing that contacts the formation water according to the appropriate protocol for construction materials specified in FC 1160.

FC 1180. ANALYTE-FREE WATER CONTAINERS

This section pertains to containers that are purchased to transport, store and dispense analyte-free water. It does not apply to water that has been purchased in containers. See FC 1002, section 3 for appropriate construction materials.

1. NEW CONTAINERS

1.1. Wash containers and caps according to FC 1131, omitting the solvent rinse if plastic (polyethylene or polypropylene) containers are being cleaned.

1.2. Cap with Teflon film or the bottle cap. The bottle cap must be composed of the same material as the container and cannot be lined.

2. REUSED CONTAINERS

2.1. Immediately after emptying, cap with aluminum foil, Teflon film or the container cap.

2.2. Wash the exterior of the container with lab-grade detergent solution (see FC 1001, section 1) and rinse with analyte-free water.

2.3. Rinse the interior thoroughly with analyte-free water.

2.4. Invert and allow to drain and dry.

FC 1190. ICE CHESTS AND SHIPPING CONTAINERS

1. Wash the exterior and interior of all ice chests with laboratory detergent (see FC 1001, section 1) after each use.

2. Rinse with tap water and air dry before storing.

3. If the ice chest becomes severely contaminated with concentrated waste or other toxic or hazardous materials clean as thoroughly as possible, render unusable, and properly dispose.

FC 1200. Field Instruments and Drilling Equipment

FC 1210. FIELD INSTRUMENTS (TAPES, METERS, ETC.)

Follow manufacturer's recommendations for cleaning instruments. At a minimum:

1. Wipe down equipment body, probes, and cables with lab-grade detergent solution (see FC 1001, section 1). Check manufacturer's instructions for recommendations and/or restrictions on cleaning.

2. Rinse thoroughly with tap water.

3. Rinse thoroughly with analyte-free water.

4. Store equipment according to the manufacturer's recommendation or wrap equipment in aluminum foil, untreated butcher paper or untreated plastic bags to eliminate potential environmental contamination.

FC 1220. SOIL BORING EQUIPMENT

This section pertains only to equipment that is not used to collect samples. Clean split spoons, bucket augers and other sampling devices according to FC 1131.

1. Remove oil, grease, and hydraulic fluid from the exterior of the engine and power head, auger stems, bits and other associated equipment with a power washer or steam jenny or wash by hand with a brush and sudsy waster (no degreasers).

2. Rinse thoroughly with tap water.

FC 1230. WELL CASING CLEANING

These are recommended procedures for cleaning well casing and riser pipes. Use procedures specified by a FDEP contract, order, permit, or rule, if different or more stringent than the procedures outlined below.

1. FDEP recommends only using casing that is designed for subsurface environmental groundwater monitoring.
2. Casing that has been contaminated with grease, hydraulic fluid, petroleum fuel, etc. may require additional cleaning or deemed unusable.
3. All casings and riser pipes should be cleaned before installation, unless the casing is received wrapped and ready for installation:
 - 3.1. Steam clean all casings and riser pipes except PVC. Steam cleaning criteria shall meet the following: water pressure - 2500 psi; water temperature - 200°F.
 - 3.2. Rinse thoroughly with tap (potable) water. This tap water must be free of the analytes of interest.

FC 1300. Sample Containers

FC 1310. OBTAINING CLEAN CONTAINERS

1. Obtain clean sample containers in one of three ways:
 - 1.1. From commercial vendors as precleaned containers. The cleaning grades must meet EPA analyte specific requirements. Keep all records for these containers (lot numbers, certification statements, date of receipt, etc.) and document the container's intended uses;
 - 1.2. From internal groups within the organization that are responsible for cleaning and maintaining containers according to the procedures outlined in FC 1320; or
 - 1.3. From a subcontracted laboratory that is accredited under the National Environmental Laboratory Accreditation Program (NELAP).
 - 1.3.1. The contractor must verify that the laboratory follows the container cleaning procedures outlined in FC 1320.
 - 1.3.2. If the laboratory cleaning procedures are different, the contractor must require that the laboratory use the following cleaning procedures or provide documentation and historical records to show that their in-house procedure produces containers that are free from the analytes of interest.

FC 1320. CONTAINER CLEANING PROCEDURES

1. Refer to Table FC 1000-2. Follow the cleaning steps in the order specified in the chart.
2. Cleaning procedures that are different from those outlined in FC 1320 may be used as long as blanks collected in the containers are free from the analytes of interest and any analytical interferences and the cleaning procedures are supported by historical and continuing documentation.
3. Inspect all containers before cleaning.
 - 3.1. **Do not recycle or reuse containers if:**
 - 3.1.1. Containers were used to collect in-process (i.e., untreated or partially treated) wastewater samples at industrial facilities;
 - 3.1.2. A visible film, scale or discoloration remains in the container after the cleaning procedures have been used; or

3.1.3. Containers were used to collect samples at pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds. Such containers shall be properly disposed of (preferably at the facility) at the conclusion of the sampling activities.

3.1.4. If the containers described above are reused, check no less than 10% of the cleaned containers for the analytes of interest before use. If found to be contaminated (i.e., analytes of interest are found at MDL levels or higher), discard the containers.

FC 1400. Documentation

Document cleaning procedures described below for the indicated activities. See FD 1000 for additional information about required records and retention of documents.

FC 1410. FIELD EQUIPMENT

1. IN-FIELD CLEANING

1.1. Initially identify the procedures that are used to clean equipment in the field by SOP numbers and dates of usage.

1.2. Record the date and time that equipment was cleaned.

2. IN-HOUSE CLEANING

2.1. Retain any cleaning certificates, whether from a laboratory or commercial vendor.

2.2. Identify the procedure(s) that are used to clean equipment by the SOP number and dates of usage.

2.3. Record the date that the equipment was cleaned.

FC 1420. SAMPLE CONTAINERS

1. Organizations that order precleaned containers must retain the packing slips, and lot numbers of each shipment, any certification statements provided by the vendor and the vendor cleaning procedures.

2. Organizations that clean containers must maintain permanent records of the following:

2.1. Procedure(s) used to clean containers by SOP number and dates of usage.

2.2. If containers are certified clean by the laboratory the laboratory must record:

- Type of container;
- Date cleaned;
- SOP used;
- Person responsible for cleaning;
- Lot number (date of cleaning may be used) of the batch of containers that were cleaned using the same reagent lots and the same procedure;
- The results of quality control tests that were run on lot numbers; and
- Any additional cleaning or problems that were encountered with a specific lot.

FC 1430. REAGENTS AND OTHER CLEANING SUPPLIES

Maintain a record of the lot number with the inclusive dates of use for all acids, solvents, and other cleaning supplies.

Appendix FC 1000
Tables, Figures and Forms

Table FC 1000-1 Procedures for Decontamination at the Base of Operations or On-site

Table FC 1000-2 Container Cleaning Procedures

Table FC 1000-1
Procedures for Decontamination at the Base of Operations or On-Site

Construction Material	Analyte Group Sampled	SOP Reference	Base of Operations	On-Site
Teflon or Glass	All	FC 1131	Follow as written	May substitute ambient temperature water for the hot water rinses and hot detergent solution
	Extractable & Volatile Organics Petroleum Hydrocarbons		May omit acid rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution May omit acid rinse
	Metals ¹ Radionuclides For ultra trace metals, refer to FS 8200		May omit solvent rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution May omit solvent rinse
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		May omit solvent rinse	Rinse several times with water Rinse several times with sample water from the next sampling location
	Microbiological – Viruses Microbiological - Bacteria		Omit solvent and acid rinses	Rinse several times with water Rinse several times with sample water from the next sampling location
Metallic (stainless steel, brass, etc.)	All Extractable & Volatile Organics Petroleum Hydrocarbons	FC 1131	Omit the acid rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution Omit the acid rinse
	Metals Radionuclides		Omit the acid rinse May omit the solvent rinse	May substitute ambient temperature water for the hot water rinses and hot detergent solution Omit the acid rinse May omit the solvent rinse
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		Omit solvent rinse May omit the acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location

Table FC 1000-1
Procedures for Decontamination at the Base of Operations or On-Site

Construction Material	Analyte Group Sampled	SOP Reference	Base of Operations	On-Site
	Microbiological – Viruses Microbiological - Bacteria		Omit solvent and acid rinses	Rinse several times with water Rinse several times with sample water from the next sampling location
Plastic (Polyethylene, polypropylene, PVC, silicone, acrylic	Volatile and Extractable Organics;	FC 1132	Follow as written.	May substitute ambient temperature water for the hot water rinses and hot detergent solution
	Inorganic Nonmetallics Physical & Aggregate Properties Aggregate Organics Biologicals Volatile Inorganics		May omit the acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location
	Microbiological – Viruses Microbiological - Bacteria		Omit acid rinse	Rinse several times with water Rinse several times with sample water from the next sampling location

ⁱ Do not use glass if collecting samples for boron or silica.

Table FC 1000-2
Container Cleaning Procedures

ANALYSIS / ANALYTE GROUP	CLEANING STEPS See Description Below
Extractable Organics	1, 2, 4, 6 (not required if Luminex (or equivalent is used), (5 and 7 optional), 11
Volatile Organics	1, 2, 4, (6 optional, methanol only), 7
Metals	1, 2, 3, 4, 8, 11 ** **Procedures to clean containers for ultra-trace metals are found in FS 8200
Inorganic Nonmetallics, Radionuclides, Physical and Aggregate Properties, Aggregate Inorganics, and Volatile Inorganics	1, 2, 3*, 4, 8, 11 * For nutrients, replace nitric acid with hydrochloric acid, or use a hydrochloric acid rinse after the nitric acid rinse. See FC 1001, section 4
Petroleum Hydrocarbons, and Oil and Grease	1, 2, 3, 4, (5, 6, 7 optional), 11
Microbiological (all)	1, 2, 4, 8, 9, 11
Toxicity Tests (Includes Bioassays)	1, 2, 10, 2, 4, 6.1, (10 optional), 11

NOTE: Steps 1 and 2 may be omitted when cleaning new, uncertified containers.

1. Wash with hot tap water and a brush using a suitable laboratory-grade detergent:
 - 1.1. Volatile and Extractable Organics, Petroleum Hydrocarbon, Oil and Grease: Luminex, Liqui-Nox, Alconox or equivalent;
 - 1.2. Inorganic nonmetallics: Liqui-Nox or equivalent;
 - 1.3. Metals: Liqui-Nox, Acationox, Micro or equivalents;
 - 1.4. Microbiologicals (all): Must pass an inhibitory residue test.
2. Rinse thoroughly with hot tap water.
3. Rinse with 10% nitric acid solution.
4. Rinse thoroughly with analyte-free water (deionized or better).
5. Rinse thoroughly with pesticide-grade methylene chloride.
6. Rinse thoroughly with pesticide-grade isopropanol, acetone or methanol.
 - 6.1. For bioassays, use only acetone, and only when containers are glass.
7. Oven dry at 103°C to 125°C for at least 1 hour.

Table FC 1000-2
Container Cleaning Procedures

- 7.1. VOC vials and containers must remain in the oven in a contaminant-free environment until needed. They should be capped in a contaminant-free environment just prior to dispatch to the field.
8. Invert and air-dry in a contaminant-free environment.
9. Sterilize containers:
 - 9.1. Plastic: 60 min at 170°C, loosen caps to prevent distortion.
 - 9.2. Glass: 15 min at 121°C.
10. Rinse with 10% hydrochloric acid followed by a sodium bicarbonate solution.
11. Cap tightly and store in a contaminant-free environment until use. Do not use glass if collecting samples for boron or silica.

FD 1000. DOCUMENTATION PROCEDURES

1. INTRODUCTION:

1.1. For the creation of clear, accurate and methodical records to document all field activities affecting sample data, implement the following standard operating procedures for sample collection, sample handling and field-testing activities.

2. SCOPE AND APPLICABILITY

2.1. This SOP provides a detailed listing of the information required for documentation of all sampling procedures and field testing.

2.2. Refer to the associated sampling or field testing SOP for any requirements for the chronological or sequential documentation of data.

3. QUALITY ASSURANCE

3.1. Implement review procedures to monitor and verify accurate manual and automated data entry and recordkeeping for all documentation tasks outlined in this SOP.

FD 1100. Universal Documentation Requirements

Incorporate efficient archival design and concise documentation schemes for all record systems. Ensure that the history of a sample is clearly evident in the retained records and documentation and can be independently reconstructed.

1. CRITERIA FOR ALL DOCUMENTS

1.1. Keep all applicable documentation available for inspection. Keep all original data and records as well as reduced or manipulated forms of the original data or records.

1.1.1. Authorized representatives of DEP have the legal right to inspect and request copies of any records using paper, electronic media, or other media during any DEP audit of physical facilities or on-site sampling events, and for any data validations conducted for applicable project data submitted to DEP.

1.2. Record enough information so that clarifications, interpretations, or explanations of the data are not required from the originator of the documentation.

1.3. Clearly indicate the nature and intent of all documentation and all record entries.

1.4. Link citations to SOPs and other documents by the complete name, reference or publication number, revision number, and revision date for the cited document, when applicable. Also assign this information to internally generated SOPs.

1.5. Retain copies of all revisions of all cited documents as part of the documentation archives.

2. PROCEDURES

2.1. Sign, initial or encode all documentation entries made to paper, electronic or other records with a link indicating the name and responsibility of the author making the data entry, clearly indicating the reason for the signature, initials or code (e.g., "sampled by"; "released by"; "prepared by"; "reviewed by").

2.2. In order to abbreviate record entries, make references to procedures written in internal SOPs or methodology and procedures promulgated by external sources.

DEP-SOP-001/01
FD 1000 Documentation Procedures

2.2.1. Document the intent to use SOPs other than the DEP SOPs, or to use allowable modifications to the DEP SOPs by recording the effective date of use for all such SOPs or modifications.

2.2.1.1. Retain any correspondence with DEP regarding approval to use alternative procedures for any projects.

2.2.2. Authorize all internal SOPs with the signatures of the quality assurance officer(s) and manager(s) responsible for implementation of the SOPs. Record the dates of signature.

2.3. Employ straightforward archiving of records to facilitate documentation tracking and retrieval of all current and archived records for purposes of inspection, verification, and historical reconstruction of all procedures and measurement data.

2.4. Keep copies or originals of all documentation, including documentation sent to or received from external parties.

2.5. Use waterproof ink for all paper documentation.

2.6. Do not erase or obliterate entry errors on paper records. Make corrections by marking a line through the error so that it is still legible. Initial or sign the marked error and its correction.

2.7. Maintain electronic audit trails for all edited electronic records, if possible. Utilize software that allows tracking of users and data edits, if available. Software that prompts the user to double-check edits before execution is also preferred. See FD 1200.

2.8. Clearly link all documentation associated with a sample or measurement. Make cross-references to specific documentation when necessary.

2.9. Link final reports, data summaries, or other condensed versions of data to the original sample data, including those prepared by external parties.

3. RETENTION REQUIREMENTS

3.1. Per the DEP QA Rule, 62-160.220 & .340, F.A.C., keep all documentation archives for a minimum of 5 years after the date of project completion or permit cycle unless otherwise specified in a Department contract, order, permit, or Title 62 rules.

FD 1200. Electronic Documentation

Handle electronic (digital) data as with any data according to applicable provisions of FD 1100.

1. RETENTION OF AUTOMATIC DATA RECORDING PRODUCTS

1.1. For data not directly read from the instrument display and manually recorded, retain all products or outputs from automatic data recording devices, such as strip chart recorders, integrators, data loggers, field measurement devices, computers, etc. Store records in electronic, magnetic, optical, or paper form, as necessary.

1.1.1. Retain all original, raw output data. Ensure archiving of these data prior to subsequent reduction or other manipulation of the data.

1.2. Identify output records as to purpose, analysis date and time, field sample identification number, etc. Maintain clear linkage with the associated sample, other data source or measured medium and specific instrument used to make the measurement.

2. ELECTRONIC DATA SECURITY

DEP-SOP-001/01
FD 1000 Documentation Procedures

- 2.1. Control levels of access to electronic data systems as required to maintain system security and to prevent unauthorized editing of data.
- 2.2. Do not alter raw instrumentation data or original manual data records in any fashion without retention of the original raw data.
- 2.3. Maintain secure computer networks and appropriate virus protection as warranted for each system design.
3. ELECTRONIC DATA STORAGE AND DOCUMENTATION
 - 3.1. Store all electronic, magnetic, and optical media for easy retrieval of records.
 - 3.1.1. Ensure that all records can be printed to paper if needed for audit or verification purposes.
 - 3.1.2. If it is anticipated that the documentation archive will become unreadable due to obsolescence of a particular storage technology, retain a paper archive of the data or transfer to other suitable media.
 - 3.2. For easy retrieval of records, link all stored data to the associated sample data or other data source.
 - 3.3. Back up all data at a copy rate commensurate with the level of vulnerability of the data. Consider replicating all original data as soon as possible after origination.
4. SOFTWARE VERIFICATION
 - 4.1. Ensure that any software used to perform automatic calculations conforms to required formulas or protocols.
 - 4.2. Document all software problems and their resolution in detail, where these problems have irretrievably affected data records or linkage. Record the calendar date, time, responsible personnel, and relevant technical details of all affected data and software files. Note all software changes, updates, installations, etc. per the above concerns. File and link all associated service records supplied by vendors or other service personnel.
5. PROTECTION OF EQUIPMENT AND STORAGE MEDIA
 - 5.1. Place stationary computers, instrumentation, and peripheral devices in locations of controlled temperature and humidity and away from areas where the potential for fluid leaks, fire, falling objects, or other hazards may exist. In the field, protect portable equipment from weather, excess heat or freezing, storage in closed vehicles, spillage from reagents and samples, etc.
 - 5.2. Protect storage media from deteriorating conditions such as temperature, humidity, magnetic fields, or other environmental hazards as above.
6. ELECTRONIC SIGNATURES – Documents signed with electronic signatures must be consistent with the requirements of 62-160.405, F.A.C.:
 - 6.1. the integrity of the electronic signature can be assured;
 - 6.2. the signature is unique to the individual;
 - 6.3. the organization using electronic signatures has written policies for the generation and use of electronic signatures; and
 - 6.4. the organization using electronic signatures has written procedures for ensuring the security, confidentiality, integrity and auditability of each signature.

FD 1300. Documentation Using Other Media

1. UNIVERSAL REQUIREMENTS

1.1. Handle documentation prepared using other media according to FD 1100.

2. PROTECTION OF STORED MEDIA

2.1. Store media such as photographs, photographic negatives, microfilm, videotape, etc. under conditions generally prescribed for these media by manufacturers and conducive to long-term storage and protection from deterioration. See also FD 1200, section 5, above.

FD 2000. DOCUMENTATION OF CLEANED EQUIPMENT, SAMPLE CONTAINERS, REAGENTS AND SUPPLIES

When providing sample containers, preservation reagents, analyte-free water or sampling equipment, document certain aspects of these preparations.

1. EQUIPMENT CLEANING DOCUMENTATION

1.1. Document all cleaning procedures by stepwise description in an internal SOP if cleaning procedures in the DEP SOP have been modified for use. Alternatively, cite the DEP SOP procedures in the cleaning record for the applicable equipment.

1.2. Record the date of cleaning.

1.2.1. If items are cleaned in the field during sampling activities for a site, document the date and time when the affected equipment was cleaned. Link this information with the site and the cleaning location at the site.

1.3. Retain or make accessible any certificates of cleanliness issued by vendors supplying cleaned equipment or sample containers.

1.3.1. Retain from the vendor or document for internal cleaning the following information for sample containers, as applicable:

- Packing slip and cleanliness certificates from vendors
- Container types and intended uses
- Lot numbers or other designations for groups of containers cleaned together using the same reagents and procedures
- Dates of cleaning
- Cleaning procedures or reference to internal cleaning SOPs or DEP SOPs
- Cleaning personnel names
- Results of quality control analyses associated with container lots
- Comments about problems or other information associated with container lots

2. SAMPLING KIT DOCUMENTATION

If supplied to a party other than internal staff, transmit to the recipient the following information pertaining to sampling equipment or other implements, sample containers, reagent containers, analyte-free water containers, reagents or analyte-free water supplied to the recipient.

DEP-SOP-001/01
FD 1000 Documentation Procedures

- Quantity, description and material composition of all containers, container caps or closures or liners for caps or closures
 - Intended application for each sample container type indicated by approved analytical method or analyte group(s)
 - Type, lot number, amount and concentration of preservative added to clean sample containers and/or shipped as additional preservative
 - Intended use for any additional preservatives or reagents provided
 - Description of any analyte-free water (i.e., deionized, organic-free, etc.)
 - Date of analyte-free water containerization
 - Date of sampling kit preparation
 - Description and material composition of all reagent transfer implements (e.g., pipets) shipped in the sampling kit and the analyte groups for which the implements have been cleaned or supplied
 - Quantity, description and material composition of all sampling equipment and pump tubing (including equipment supplied for filtration) and the analyte groups for which the equipment has been cleaned or supplied
 - Tare weight of VOC vials, as applicable (this item is necessary when EPA 5035 VOC sample vials are provided for soil samples)
3. DOCUMENTATION FOR REAGENTS AND OTHER CHEMICALS
- 3.1. Keep a record of the lot numbers and inclusive dates of use for all reagents, detergents, solvents and other chemicals used for cleaning and sample preservation.
- 3.1.1. See FD 4000 below for documentation requirements for reagents used for field testing.

FD 3000. DOCUMENTATION OF EQUIPMENT MAINTENANCE

1. Log all maintenance and repair performed for each instrument unit, including routine cleaning procedures, corrective actions performed during calibrations or verifications, and solution or parts replacement for instrument probes.
 - 1.1. Include the calendar date for the procedures performed.
 - 1.2. Record names of personnel performing the maintenance or repair tasks.
 - 1.2.1. Describe any malfunctions necessitating repair or service.
2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit employed. This identifier may include a manufacturer name, model number, serial number, inventory number, or other unique identification.
3. Retain vendor service records for all affected instruments.
4. Record the following for rented equipment:

- Rental date(s)
 - Equipment type and model or inventory number or other description
5. Retain the manufacturer's operating and maintenance instructions.

FD 4000. DOCUMENTATION FOR CALIBRATION OF FIELD-TESTING INSTRUMENTS AND FIELD ANALYSES

Document acceptable instrument or measuring system calibration for each field test or analysis of a sample or other measurement medium.

FD 4100. General Documentation for all Field Testing

1. STANDARD AND REAGENT DOCUMENTATION: Document information about standards and reagents used for calibrations, verifications, and sample measurements.
 - 1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.
 - 1.1.1. Document acceptable verification of any standard used after its expiration date.
 - 1.2. Record the concentration or other value for the standard in the appropriate measurement units.
 - 1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.
 - 1.2.2. Retain vendor assay specifications for standards as part of the calibration record.
 - 1.2.2.1. Record the grade of standard or reagent used.
 - 1.3. When formulated in-house, document all calculations used to formulate calibration standards.
 - 1.3.1. Record the date of preparation for all in-house formulations.
 - 1.4. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).
2. FIELD INSTRUMENT CALIBRATION DOCUMENTATION: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.
 - 2.1. Retain vendor certifications of all factory-calibrated instrumentation.
 - 2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.
 - 2.2.1. Record manufacturer name, model number, and identifying number such as a serial number for each instrument unit.
 - 2.3. Record the time and date of all initial calibrations and all calibration verifications.
 - 2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.
 - 2.5. Record the name of the analyst(s) performing the calibration or verification.

2.6. Document the specific standards used to calibrate or verify the instrument or field test with the following information:

- Type of standard or standard name (e.g., pH buffer)
- Value of standard, including correct units (e.g., pH = 7.0 SU)
- Link to information recorded according to section 1 above

2.7. Retain manufacturers' instrument specifications.

2.8. Document whether successful initial calibration occurred.

2.9. Document whether each calibration verification passed or failed.

2.10. Document, according to records requirements of FD 3000, any corrective actions taken to modify instrument performance.

2.10.1. Document date and time of any corrective actions.

2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

3. Record all field-testing measurement data, to include the following:

- Project name
- Date and time of measurement or test (including time zone, if applicable)
- Source and location of the measurement or test sample (e.g., monitoring well identification number, outfall number, station number or other description)
- Latitude and longitude of sampling source location (if required)
- Analyte or parameter measured
- Measurement or test sample value
- "J" data qualifier code for estimated measurement or test sample value
- Reporting units for the measurement
- Initials or name of analyst performing the measurement
- Unique identification of the specific instrument unit used for the test (see 2.2 above)

FD 5000. DOCUMENTATION OF SAMPLE COLLECTION, PRESERVATION AND TRANSPORT

Follow these procedures for all samples. See FD 5100 - FD 5427 below for additional documentation for specific sampling activities. See example Forms in FD 9000 below for example formats for documenting specific sampling and testing procedures.

1. SAMPLE IDENTIFICATION REQUIREMENTS

1.1. Ensure that labels are waterproof and will not disintegrate or detach from the sample container when wet, especially under conditions of extended submersion in ice water typically accumulating in ice chests or other transport containers.

DEP-SOP-001/01
FD 1000 Documentation Procedures

1.2. Label or tag each sample container with a unique field identification code that adequately distinguishes each sample according to the following criteria. The code must adequately link the sample container with all of the information about the sample contained in the permanent field record.

1.2.1. Link the unique field identification code to the sample source or sampling point identification, the date of sample collection, the time of sample collection (for maximum holding times equal to or less than 48 hours), the analytes of interest and the preservation technique.

1.2.2. Label or tag each sample container for the following types of samples with a unique field identification code:

- Quality control samples such as duplicate samples, other replicate samples or split samples collected for the same analyte or group of analytes
- Field samples or quality control samples collected using a different sample collection technique for the same analyte or group of analytes (for example, if both a bailer and a pump are used to collect samples for metals analysis, label the bailer sample to distinguish it from the pump sample)

1.2.3. The color, size, shape, or material composition of sample containers and caps cannot substitute for the information required in 1.2.1. – 1.2.2. Above.

1.2.4. The unique field identification code and any other information included on the container label or tag must allow the analyzing laboratory to independently determine the sample collection date, the sample collection time (for maximum holding times \leq 48 hours), the sample preservation and the analytical tests to be performed on each container or group of containers.

1.3. Attach the label or tag so that it does not contact any portion of the sample that is removed or poured from the container.

1.4. Record the unique field identification code on all other documentation associated with the specific sample container or group of containers.

2. GENERAL REQUIREMENTS FOR SAMPLING DOCUMENTATION: Record the following information for all sampling:

2.1. Names of all sampling team personnel on site during sampling

2.2. Date and time of sample collection (indicate hours and minutes)

2.2.1. Use 24-hour clock time or indicate A.M. and P.M.

2.2.2. Note the exact time of collection for individual sample containers for time-sensitive analyses with a maximum holding time of 48 hours or less.

2.3. Ambient field conditions, to include, but not limited to information such as weather, tides, etc.

2.4. Comments about samples or conditions associated with the sample source (e.g., turbidity, sulfide odor, insufficient amount of sample collected)

2.5. Specific description of sample location, including site name and address

2.5.1. Describe the specific sampling point (e.g., monitoring well identification number, outfall number, station number, etc.).

2.5.2. Determine latitude and longitude of sampling source location (if required).

DEP-SOP-001/01
FD 1000 Documentation Procedures

- 2.5.3. Locate sampling points on scaled maps or drawings where applicable.
 - 2.6. Record the unique field identification code for each sample container and parameters to be analyzed, per section 1 above. The code must adequately link the sample container or group of containers with all of the information about the sample contained in the permanent field record.
 - 2.7. Number of containers collected for each unique field identification code
 - 2.8. Matrix sampled
 - 2.9. Type of field sample collected, such as grab, composite or other applicable designation.
 - 2.10. Field-testing measurement data:
 - 2.10.1. See FD 4000 above for specific details.
 - 2.11. Calibration records for field-testing equipment
 - 2.11.1. See FD 4000 above for specific details.
 - 2.12. Preservation for each container
 - 2.12.1. Indicate whether samples are chemically preserved on-site by the sampling team or, alternatively, were collected in prepreserved (predosed) containers.
 - 2.12.2. Indication of any tests performed in the field to determine the presence of analytical interferences in the sample.
 - 2.12.3. Indication of any treatments of samples performed in the field to eliminate or minimize analytical interferences in the sample.
 - 2.12.4. See FD 5100, section 1.
 - 2.13. Purging and sampling equipment used, including the material composition of the equipment and any expendable items such as tubing.
 - 2.14. Types, number, collection location and collection sequence of quality control samples
 - 2.14.1. Include a list of equipment that was rinsed to collect any equipment blanks.
 - 2.15. Use of fuel powered vehicles and equipment
 - 2.16. Number of subsamples and amount of each subsample in any composite samples
 - 2.16.1. Include sufficient location information for the composite subsamples per 2.4 above.
 - 2.17. Depth of all samples or subsamples
 - 2.18. Signature(s) or initials of sampler(s)
3. SAMPLE TRANSMITTAL RECORDS: Transmit the following information to the analytical laboratory or other receiving party. Link transmittal records with a given project and retain all transmittal records.
- Site name and address – Note: Client code is acceptable if samples are considered sensitive information and if the field records clearly trace the code to a specified site and address.
 - Date and time of sample collection

- Name of sampler responsible for sample transmittal
- Unique field identification codes for each sample container
- Total number of samples
- Required analyses
- Preservation protocol
- Comments about sample or sample conditions
- Identification of common carrier (if used)

4. SAMPLE TRANSPORT

4.1. If shipping transmittal forms in the transport containers with the samples, place the forms in a waterproof enclosure and seal.

4.2. For common carrier shipping, seal transport containers securely with strapping tape or other means to prevent lids from accidentally opening.

4.2.1. Keep all shipping bills from common carriers with archived transmittal records.

5. ANCILLARY FIELD RECORDS: Link any miscellaneous or ancillary records (photographs, videotapes, maps, etc.) to specific sampling events such that these records are easily traceable in the data archives associated with the project, sampling date and sample source(s).

FD 5100. Documentation Specific To Aqueous Chemistry Sampling

1. SAMPLE PRESERVATION: Document preservation of all samples according to the following instructions.

1.1. List the chemical preservatives added to the sample.

1.2. Record the results of pH verification performed in the field, including the pH value of the sample (if applicable). Note any observations about changes in the sample as a result of adding preservative to the sample or mixing the sample with the preservative.

1.3. Record the amount of preservative added to samples and the amount of any additional preservative added. The amount dosed into sample containers supplied with premeasured preservatives must also be recorded.

1.3.1. For documentation of procedures for preservation for routine samples, cite DEP SOPs or internal SOPs for this information.

1.3.2. Record instances of deviation from preservation protocols found in SOPs when non-routine or problematic samples are collected.

1.4. Record the use of ice or other cooling method, when applicable.

2. GROUNDWATER SAMPLING

2.1. Record or establish a documentation link to the following information for all samples. See section 3 below for in-place plumbing:

- Well casing composition and diameter of well casing
- A description of the process and the data used to design the well

DEP-SOP-001/01
FD 1000 Documentation Procedures

- The equipment and procedure used to install the well
 - The well development procedure
 - Pertinent lithologic or hydrogeologic information
 - Ambient conditions at the wellhead or sampling point that are potential sources of unrepresentative sample contamination
 - Water table depth and well depth
 - Calculations used to determine purge volume
 - Total amount of water purged
 - Date well was purged
 - Purging equipment used
 - Sampling equipment used
 - Well diameter
 - Total depth of well
 - Depth to groundwater
 - Volume of water in the well
 - Purging method
 - Placement depth of tubing or pump intake
 - Depth and length of screened interval
 - Times for beginning and ending of purging
 - Total volume purged
 - Times of stabilization parameter measurements
 - Purging rate, including any changes in rate
 - Temperature measurements
 - pH measurements
 - Specific conductance measurements
 - Dissolved oxygen measurements
 - Turbidity measurements
 - Site or monitoring well conditions impacting observed dissolved oxygen and turbidity measurements
 - Color of groundwater
 - Odor of groundwater
- 2.2. Record the following for Water Level and Purge Volume Determination (FS 2211):
- Depth to groundwater
 - Total depth of well

DEP-SOP-001/01
FD 1000 Documentation Procedures

- Length of water column
- Well diameter
- Volume of water in the well
- Volume of pump
- Tubing diameter
- Length of tubing
- Volume of flow cell
- Volume in the pumping system

2.3. Record the following for Well Purging (FS 2212)

- Calculations for pumping rates, including any changes in rates
- Flow meter readings
- Volume of water purged
- Placement depth of tubing or pump intake
- Depth and length of screened interval
- Time needed to purge one (1) well volume or purging equipment volume
- Well volumes or purging equipment volumes purged
- Temperature measurements
- pH measurements
- Specific conductance measurements
- Dissolved oxygen measurements
- Turbidity measurements
- Purging rate, including any changes in rate
- Drawdown in the well

3. IN-PLACE PLUMBING SOURCES INCLUDING DRINKING WATER SYSTEMS

3.1. Record the following for all samples:

- Plumbing and tap material construction (if known)
- Flow rate at which well was purged
- Amount of time well was allowed to purge
- Flow rate at time of sample collection
- Public water system identification number (if applicable)
- Name and address of water supply system and an emergency phone number for notification of sample results (if applicable)

4. SURFACE WATER SAMPLING

- Sample collection depth

DEP-SOP-001/01
FD 1000 Documentation Procedures

- Beginning and ending times (24 hr) for timed composite sampling
- Type of composite (e.g., flow-proportioned, continuous, etc.)

5. WASTEWATER SAMPLING

- Beginning and ending times (24 hr) for timed composite sampling
- Type of composite (e.g. flow-proportioned, continuous, etc.)

FD 5120. RECORDS FOR NON-AQUEOUS ENVIRONMENTAL SAMPLES

Document the following information for all samples when using the indicated procedures.

FD 5130. DOCUMENTATION SPECIFIC TO SOIL SAMPLING (FS 3000)

1. GENERAL SOIL SAMPLING

- Sample collection depth
- Areal location of sample
- Sample collection device

2. Sampling for Volatile Organic Compounds (VOC) per EPA Method 5035

- Tare weight of VOC sample vial (if applicable)
- Weight of sample (if applicable)

FD 5140. DOCUMENTATION SPECIFIC TO SEDIMENT SAMPLING (FS 4000)

1. General Sediment Sampling

- Sample collection depth
- Areal location of sample
- Sample collection device

2. Sampling for Volatile Organic Compounds (VOC) per EPA Method 5035

- Tare weight of VOC sample vial (if applicable)
- Weight of sample (if applicable)

FD 5200. Documentation Specific to Waste Sampling (FS 5000)

1. DRUM SAMPLING

1.1. Record the following information for each drum:

- Type of drum and description of contents
- Drum number, if applicable
- Terrain and drainage condition
- Shape, size and dimensions of drum
- Label wording or other markings

DEP-SOP-001/01
FD 1000 Documentation Procedures

- Dimensional extent of leaks or spills associated with the drum
- Drum location (or location map)

1.2. Record the following information for the drum sample(s):

- Description of phases, colors, crystals, powders, sludges, etc.
- Stratified layers sampled, including aliquot amounts for composites, if applicable

1.3. Record the following for field testing results on opened drums and drum samples:

- Background readings for OVA meters
- Sample readings for OVA meters
- Type of OVA probe
- Radiation background reading and sample radiation reading
- Type of radiation monitor used
- Oxygen and LEL readings from container opening
- Water reactivity results
- Specific gravity
- PCB test results
- Water solubility results
- pH of aqueous wastes
- Results of chemical test strips
- Ignitability results
- Results of other chemical hazard test kits
- Miscellaneous comments for any tests

2. Documentation for Tanks

2.1. Record the following information for the tank:

- Type of tank, tank design and material of construction of tank
- Description of tank contents and markings
- Tank number or other designation, if applicable
- Terrain and drainage condition
- Shape, size and dimensions of tank
- Label or placard wording or other markings
- Dimensional extent of leaks or spills associated with the tank
- Tank location (or location map)

2.2. Record the following information for the tank sample(s):

- Description of phases, colors, crystals, powders, sludges, etc.

DEP-SOP-001/01
FD 1000 Documentation Procedures

- Stratified layers sampled, including aliquot amounts for composites, if applicable

2.3. Record the following for field testing results on opened tanks and tank samples:

- Background readings for OVA meters
- Sample readings for OVA meters
- Type of OVA probe
- Radiation background reading and sample radiation reading
- Type of radiation monitor used
- Oxygen and LEL level from container opening
- Water reactivity results
- Specific gravity
- PCB test results
- Water solubility results
- pH of aqueous wastes
- Results of chemical test strips
- Ignitability results
- Results of other chemical hazard test kits
- Miscellaneous comments for any tests

3. DOCUMENTATION FOR WASTE LEACHATE AND WASTE SUMP SAMPLES

3.1. Document information specific to leachate and sump sampling according to the documentation requirements for the respective DEP SOPs employed to collect samples (FS 2100, FS 2200, FS 4000, FS 5100 and FS 5200).

4. DOCUMENTATION FOR WASTE PILE SAMPLES

4.1. Document information specific to waste pile sampling according to associated regulatory requirements for the project.

5. DOCUMENTATION FOR WASTE IMPOUNDMENT AND WASTE LAGOON SAMPLES

5.1. Document information specific to impoundment and lagoon sampling according to the documentation requirements for the respective DEP SOPs employed to collect samples (FS 2100, FS 4000, FS 5100, and FS 5200).

FD 5300. Documentation for Biological Sampling

The following SOP sections list required documentation items for specific biological sampling procedures, as indicated.

FD 5310. DOCUMENTATION FOR BIOLOGICAL AQUATIC HABITAT CHARACTERIZATION

Minimum documentation required for biological habitat characterization and sampling is listed below according to requirements as specified in the indicated sampling and field-testing DEP SOPs.

FD 5311. *Physical/Chemical Characterization for Biological Sampling (FT 3001)*

1. Record the following information or use the Physical/Chemical Characterization Field Sheet (Form FD 9000-3):

- Submitting agency code
- Submitting agency name
- STORET station number
- Sample date
- Sample location including county
- Field identification
- Receiving body of water
- Time of sampling
- Percentage of land-use types in the watershed that drain to the site
- Potential for erosion within the portion of the watershed that affects the site
- Local non-point-source pollution potential and obvious sources
- Typical width of 100-meter section of river or stream
- Size of the system or the size of the sample area within the system (lake, wetland, or estuary)
- Three measurements of water depth across the typical width transect
- Three measurements of water velocity, one at each of the locations where water depth was measured
- Vegetated riparian buffer zone width on each side of the stream or river or at the least buffered point of the lake, wetland or estuary
- Presence of artificial channelization in the vicinity of the sampling location (stream or river)
- Description of state of recovery from artificial channelization
- Presence or absence of impoundments in the area of the sampling location
- Vertical distance from the current water level to the peak overflow level
- Distance of the high water mark above the stream bed
- Observed water depth at high water mark location
- Percentage range that best describes the degree of shading in the sampling area
- Any odors associated with the bottom sediments
- Presence or absence of oils in the sediment
- Any deposits in the area, including the degree of smothering by sand or silt
- Depth of each water quality measurement
- Temperature

DEP-SOP-001/01
FD 1000 Documentation Procedures

- pH
- Dissolved oxygen
- Specific conductance
- Salinity
- Secchi depth
- Type of aquatic system sampled
- Stream magnitude (order designation)
- Description of any noticeable water odors
- Term that best describes the relative coverage of any oil on the water surface
- Term that best describes the amount of turbidity in the water
- Term that best describes the color of the water
- Weather conditions during the time of sampling
- Any other conditions/observations that are helpful in characterizing the site
- Relative abundances of periphyton, fish, aquatic macrophytes and iron/sulfur bacteria
- List and map of dominant vegetation observed
- Sampling team designation
- Signature(s) of sampler(s)
- Signature date

2. For streams and rivers, draw a grid sketch of the site (optionally use Form FD 9000-4), showing the location and amount of each substrate type (as observed by sight or touch). Using the grid sketch, count the number of grid spaces for each substrate type. Divide each of these numbers by the total number of grid spaces contained within the site sketch. Record this percent coverage value for each substrate type. If the substrates are sampled, record the number of times each substrate is sampled by an indicated method.

3. For lakes, divide the site map into twelve sections and note visual markers that will assist in distinguishing those sections.

4. Photographs of the sampling area are also useful tools for documenting habitat conditions and identifying station location.

FD 5312. *Stream and River Biological Habitat Assessment Records (FT 3100)*

1. Record the following information or use Form FD 9000-5, Stream/River Habitat Assessment Field Sheet:

- Submitting organization name and/or code
- STORET station number
- Assessment date
- Sampling location including county
- Field identification

DEP-SOP-001/01
FD 1000 Documentation Procedures

- Receiving body of water
 - Time of sampling upon arrival at the site
2. Additionally record the following:
- Substrate diversity score
 - Substrate availability score
 - Water velocity score
 - Habitat smothering score
 - Artificial channelization score
 - Bank stability score for each bank
 - Riparian buffer zone width score for each bank
 - Riparian zone vegetation quality score for each bank
 - Primary habitat components score
 - Secondary habitat components score
 - Habitat assessment total score
 - Additional comments and observations
 - Signatures
3. Record the following information or use Form FD 9000-4, Stream/River Habitat Sketch Sheet for each 100-meter segment assessed.
- Link to the waterbody name, location of 100-meter segment, analyst name(s) and date of the assessment
 - Code, symbol or icon used to map each substrate observed in the segment
 - Proportionate sketch or map of the abundance of each habitat (substrate) observed in the 100-meter segment, oriented to the direction of flow
 - Location of velocity measurements taken within the segment
 - Location of habitats smothered by sand or silt
 - Location of unstable, eroding banks
 - Locations along the segment where the natural, riparian vegetation is altered or eliminated
 - Plant taxa observed
 - Additional notes and observations

FD 5313. *Lake Biological Habitat Assessment Records (FT 3200)*

1. Document the following information or use the Lake Habitat Assessment Field Sheet (Form FD 9000-6):
- STORET station number

DEP-SOP-001/01
FD 1000 Documentation Procedures

- Sampling date
- Sampling location including lake name
- Eco-region
- Field identification number
- County name
- Lake size
- Features observed
- Description of the hydrology of the system (water residence time)
- Lake water color
- Secchi depth score
- Vegetation quality score
- Stormwater inputs score
- Bottom substrate quality score
- Lakeside adverse human alterations score
- Upland buffer zone score
- Adverse watershed land use score
- Habitat assessment total score
- Additional comments and observations
- Name and Signature of analyst

FD 5320. BIOLOGICAL AQUATIC COMMUNITY SAMPLING RECORDS (FS 7000)

Minimum documentation required for biological sampling for procedures described in FS 7000 is listed below according to requirements as specified in the indicated sampling DEP SOPs.

FD 5321. *Periphyton Sampling Records (FS 7200)*

For each sample, record the following:

- Station sampled
- Date collected

FD 5322. *Qualitative Periphyton Sampling Records (FS 7220)*

Complete the Physical/Chemical Characterization Field Sheet (Form FD 9000-3), Stream/River Habitat Sketch Sheet (Form FD 9000-4) or site map and Stream/River Habitat Assessment Field Sheet (Form FD 9000-5), as appropriate for the water body sampled (see FT 3000 – FT 3100). Other customized formats may be used to record the information prompted on the above forms.

FD 5323. *Rapid Periphyton Survey Records (FS 7230)*

For each 100-meter reach surveyed, record the following information or use Form FD 9000-8, Rapid Periphyton Survey Field Sheet:

- Site or waterbody name
- Survey date
- Name(s) of analyst(s)
- Transect mark number (10-meter segment within the 100-meter reach)
- Transect point (1 – 9)
- Algae sample collected
- Algal thickness rank (per FS 7230 procedure)
- Algae type
- Canopy cover (per FS 7230 procedure)
- Bottom visibility
- Water color
- Additional comments or observations

FD 5324. *Lake Vegetation Index Records (FS 7310)*

Record the following information or use Form FD 9000-7, Lake Vegetation Index Data Field Sheet:

- Waterbody name
- Assessment or sampling date
- County name
- Name of analyst(s)
- STORET station number
- Signature(s) of analyst(s)
- Lake water level
- Presence of algal mats
- Lake units sampled (12-sector procedure per FS 7310)
- Taxa observed in each selected unit
- Dominant and co-dominant taxa in each unit
- Taxa collected for further identification
- Approximate water depth for each taxon collected

FD 5325. *Rapid Bioassessment (Biorecon) Records (FS 7410)*

Record the following information or use the Biorecon Field Sheet (Form FD 9000-1).

DEP-SOP-001/01
FD 1000 Documentation Procedures

- STORET station number
- Location, including latitude and longitude
- Watershed or basin name
- Family or genus of all organisms from all material in all four dipnet sweeps
- Total taxa tallies
- Taxa richness, Ephemeroptera taxa, Trichoptera taxa, Long-lived taxa, Clinger taxa, and Sensitive taxa
- Abundance code for each taxon
- Name(s) of analysts collecting and sorting samples
- Habitat types (substrates) sampled
- Name(s) of analyst(s) performing quality control
- Signatures
- Collection date and time

FD 5326. *Stream Condition Index (D-frame Dipnet) Sampling Records (FS 7420)*

1. Complete the Physical/Chemical Characterization Field Sheet (Form FD 9000-3), Stream/River Habitat Sketch Sheet (Form FD 9000-4) or site map and Stream/River Habitat Assessment Field Sheet (Form FD 9000-5) forms appropriate for the water body sampled (see FT 3000 – FT 3400). Other customized formats may be used to record the information prompted on the above forms.
2. Record the following for each sample:
 - Number of sweeps for each habitat
 - Number of containers per sample

FD 5327. *Sediment Core Biological Grab Sampling Records (FS 7440)*

Record the sampling location of site grab core samples.

FD 5328. *Sediment Dredge Biological Grab Sampling Records (FS 7450)*

Record the sampling location of site grab dredge samples.

FD 5329. *Lake Condition Index (Lake Composite) Sediment Dredge Biological Grab Sampling Records (FS 7460)*

Record the following or use DEP Form FD 9000-2 (Composite Lake Sampling Sheet):

- Sampling date
- Lake name
- Sampling equipment used
- Comments and observations

- Dredge drop number (1 – 12)
- Sampling depth for each drop number
- Sampling location of site grab dredge sample for each drop (include lake sector map)
- Sediment type(s) in grab dredge sample for each drop
- Location of any water quality measurements

FD 6000. QUALITY CONTROL DOCUMENTATION

1. Document all field quality control samples in the permanent field records.
2. At a minimum, record the following information:
 - The type, time and date that the quality control sample was collected; and
 - The preservative(s) (premeasured or added amount) and preservation checks performed.
3. If blanks are collected/prepared by the field organization, maintain records of the following:
 - Type of analyte-free water used;
 - Source of analyte-free water (include lot number if commercially purchased);
 - A list of the sampling equipment used to prepare the blank.

If items above are specified in an internal SOP, you may reference the SOP number and revision date in the field notes. Note any deviations to the procedure in the field notes.

4. For trip blanks, record the following:
 - Date and time of preparation
 - Storage conditions prior to release to the sample collecting organization
 - Type of analyte-free water used
 - Source and lot number (if applicable) of analyte-free water
 - 4.1. Include trip blank information in the sampling kit documentation per FD 2000, section 2.
5. For duplicates, record the technique that was used to collect the sample.
6. For split samples, identify the method used to collect the samples and the source(s) of the sample containers and preservatives.

FD 7000. LEGAL OR EVIDENTIARY DOCUMENTATION

1. Scope: The use of legal or evidentiary Chain-of-Custody (COC) protocols is not usually required by DEP, except for cases involving civil or criminal enforcement. Do not use these procedures for routine sampling for compliance, for example, unless evidentiary custody protocols are specifically mandated in a permit or other legal order or when required for enforcement actions.

2. General Procedural Instructions

- 2.1. Follow applicable requirements in FD 1000 – FD 5000 for all evidence samples.

2.2. Establish and maintain the evidentiary integrity of samples and/or sample containers. Demonstrate that the samples and/or sample containers were handled and transferred in such a manner as to eliminate possible tampering.

2.2.1. Document and track all time periods and the physical possession and storage of sample containers and samples from point of origin through the final analytical result and sample disposal.

FD 7100. General Requirements for Evidentiary Documentation

1. CHAIN OF CUSTODY RECORDS: Use the Chain-of-Custody (COC) records to establish an intact, contiguous record of the physical possession, storage, and disposal of sample containers, collected samples, sample aliquots, and sample extracts or digestates. For ease of discussion, the above-mentioned items are referred to as "samples".

1.1. Account for all time periods associated with the physical samples.

1.2. Include signatures of all individuals who physically handle the samples.

1.2.1. The signature of any individual on any record that is designated as part of the Chain-of-Custody is their assertion that they personally handled or processed the samples identified on the record.

1.2.2. Denote each signature with a short statement that describes the activity of the signatory (e.g., "sampled by", "received by", "relinquished by", etc.).

1.2.3. In order to simplify recordkeeping, minimize the number of people who physically handle the samples.

2. CONSOLIDATION OF RECORDS: The COC records need not be limited to a single form or document. However, limit the number of documents required to establish COC, where practical, by grouping information for related activities in a single record. For example, a sample transmittal form may contain both certain field information and the necessary transfer information and signatures for establishing delivery and receipt at the laboratory.

3. LIABILITY FOR CUSTODY DOCUMENTATION: Ensure appropriate personnel initiate and maintain sample chain-of-custody at specified times.

3.1. Begin legal chain-of-custody when the precleaned sample containers are dispatched to the field.

3.1.1. Omit the transmittal record for precleaned sample containers if the same party provides the containers and collects the samples.

3.2. Sign the COC record upon relinquishing the prepared sample kits or containers.

3.3. Sign the COC record upon receipt of the sample kits or containers.

3.4. Thereafter, ensure that all parties handling the samples maintain sample custody (i.e., relinquishing and receiving) and documentation until the samples or sampling kits are relinquished to a common carrier.

3.4.1. The common carrier should not sign COC forms.

3.4.2. Indicate the name of the common carrier in the COC record, when used. Retain shipping bills and related documents as part of the record.

3.4.3. Ensure that all other transferors and transferees releasing or accepting materials from the common carrier sign the custody record.

DEP-SOP-001/01
FD 1000 Documentation Procedures

3.5. Chain-of-custody is relinquished by the party who seals the shipping container and is accepted by the party who opens it.

3.5.1. Indicate the date and time of sealing of the transport container for shipment.

3.5.2. See FD 7200, section 3 below regarding the use of custody seals.

4. SAMPLE SHIPPING OR TRANSPORTING

4.1. Affix tamper-indicating custody seals or evidence tape before shipping samples.

4.1.1. Seal sample container caps with tamper-indicating custody seals or evidence tape before packing for shipping or transport.

4.1.2. Seal sample transport or shipping containers with strapping tape and tamper-indicating custody seals or evidence tape.

4.1.3. If the same party collects then possesses (or securely stores), packs and transports the samples from time of collection, omit any use of custody seals or evidence tape.

4.2. Keep the COC forms with the samples during transport or shipment. Place the COC records in a waterproof closure inside the sealed ice chest or shipping container.

FD 7200. Required Documentation for Evidentiary Custody

1. GENERAL CONTENT REQUIREMENTS: Document the following in COC tracking records by direct entry or linkage to other records:

- Time of day and calendar date of each transfer or handling procedure
- Signatures of transferors, transferees and other personnel handling samples
- Location of samples (if stored in a secured area)
- Description of all handling procedures performed on the samples for each time and date entry recorded above
- Storage conditions for the samples, including chemical preservation and refrigeration or other cooling
- Unique identification for all samples
- Final disposition of the physical samples
- Common carrier identity and related shipping documents

2. DOCUMENTATION CONTENT FOR SAMPLE TRANSMITTAL

Provide a Chain-of-Custody record for all evidentiary samples and subsamples that are transmitted or received by any party. Include the following information in the COC record of transmittal:

- Sampling site name and address
- Date and time of sample collection
- Unique field identification code for each sample source and each sample container
- Names of personnel collecting samples
- Signatures of all transferors and transferees

DEP-SOP-001/01
FD 1000 Documentation Procedures

- Time of day and calendar date of all custody transfers
- Clear indication of number of sample containers
- Required analyses by approved method number or other description
- Common carrier usage
- Sample container/preservation kit documentation, if applicable

3. CHAIN-OF-CUSTODY SEALS: If required, affix tamper-indicating evidence tape or seals to all sample, storage and shipping container closures when transferring or shipping sample container kits or samples to another party.

- 3.1. Place the seal so that the closure cannot be opened without breaking the seal.
- 3.2. Record the time, calendar date, and signatures of responsible personnel affixing and breaking all seals for each sample container and shipping container.
- 3.3. Affix new seals every time a seal is broken until continuation of evidentiary custody is no longer required.

FD 7300. Documenting Controlled Access to Evidence Samples

Control and document access to all evidentiary samples and subsamples with adequate tracking. Documentation must include records about each of the activities and situations listed below, when applicable to sample evidence, and must track the location and physical handling of all samples by all persons at all times. See FS 1000 for additional discussion about procedures for handling evidence samples.

1. Limit the number of individuals who physically handle the samples as much as practicable.
2. When storing samples and subsamples, place samples in locked storage (e.g., locked vehicle, locked storeroom, etc.) at all times when not in the possession or view of authorized personnel.
3. Alternatively, maintain restricted access to facilities where samples are stored. Ensure that unauthorized personnel are not able to gain access to the samples at any time.
4. Do not leave samples in unoccupied motel or hotel rooms or other areas where access cannot be controlled by the person(s) responsible for custody without first securing samples and shipping or storage containers with tamper-indicating evidence tape or custody seals.

FD 7400. Documenting Disposal of Evidence Samples

1. Dispose of the physical samples only with the concurrence of the affected legal authority, sample data user, and/or submitter/owner of the samples.
2. Record all conditions of disposal and retain correspondence between all parties concerning the final disposition of the physical samples.
3. Record the date of disposal, the nature of disposal (i.e., sample depleted, sample flushed into sewer, sample returned to client, etc.), and the name of the individual who performed the disposal. If samples are transferred to another party, document custody transfer in the same manner as other transfers (see FD 7000 – FD 7200).

FD 8000. (RESERVED)

FD 9000. FORMS

Forms to facilitate documentation of sampling, field-testing, and biological laboratory calculation activities are available on the Department's website. These forms are for unrestricted public use and are presented in example formats. *The use of these forms is not mandatory. However, **some** of the data elements and other information denoted by the form prompts comprise **required documentation** items. Not all required documentation is illustrated in the form examples.* Customize these forms as needed. These forms are available as separate document files. The following forms are incorporated into the indicated SOPs for convenience of use:

- Form FD 9000-1 Biorecon Field Sheet (FS 7000)
- Form FD 9000-2 Composite Lake Sampling Sheet for <1000 Acres (FS 7000)
- Form FD 9000-3 Physical/Chemical Characterization Field Sheet (FT 3000)
- Form FD 9000-4 Stream/River Habitat Sketch Sheet (FT 3000)
- Form FD 9000-5 Stream/River Habitat Assessment Field Sheet (FT 3000)
- Form FD 9000-6 Lake Habitat Assessment Field Sheet (FT 3000)
- Form FD 9000-7 Lake Vegetation Index Data Field Sheet (FS 7000)
- Form FD 9000-8 Rapid Periphyton Survey Field Sheet (FS 7000)

FS 1000. GENERAL SAMPLING PROCEDURES

See also the following Standard Operating Procedures:

- FA 1000 and 2000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000-9000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements

FS 1001. Preliminary Activities

1. Begin each sampling trip with some planning and coordination. Refer to FM 1000 for recommendations and suggestions on laboratory selection and communication, and field mobilization.

1.1. DEP recommends that a minimum of two people be assigned to a field team. In addition to safety concerns, the process of collecting the samples, labeling the containers and completing the field records is much easier if more than one person is present.

1.2. If responding to incidents involving hazardous substances, DEP recommends that four or five people be assigned to the team.

2. EQUIPMENT

2.1. Select appropriate equipment based on the sampling source (see FS 2000 to FS 8200), the analytes of interest and the sampling procedure.

2.1.1. If properly cleaned, sample containers may be used as collection devices or intermediate containers.

2.2. The equipment construction must be consistent with the analytes or analyte groups to be collected (see Tables FS 1000-1 and FS 1000-2).

2.3. Bring precleaned equipment to the field or use equipment that has been certified clean by the vendor or laboratory.

3. DEDICATED EQUIPMENT STORAGE

3.1. Store all dedicated equipment (except dedicated pump systems or dedicated drop pipes) in a controlled environment.

3.2. If possible, store equipment in an area that is located away from the sampling site. If equipment other than dedicated pumps or dedicated drop pipes is stored in monitoring wells, suspend the equipment above the formation water.

3.3. Securely seal the monitoring well in order to prevent tampering between sampling events.

3.4. Decontaminate all equipment (except dedicated pumps or drop pipes) before use according to the applicable procedures in FC 1000.

4. SAMPLE CONTAINERS

4.1. The analyses to be performed on the sample determine the construction of sample containers.

4.2. Inspect all containers and lids for flaws (cracks, chips, etc.) before use. Do not use any container with visible defects or discoloration.

FS 1002. *Contamination Prevention and Sample Collection Order*

1. CONTAMINATION PREVENTION

1.1. Take special effort to prevent cross contamination and contamination of the environment when collecting samples. Protect equipment, sample containers and supplies from accidental contamination.

1.1.1. Do not insert pump tubing, measurement probes, other implements, fingers, etc. into sample containers or into samples that have been collected for laboratory analysis.

1.1.1.1. If it is necessary to insert an item into the container or sample, ensure that the item is adequately decontaminated for the analytes of interest to be analyzed in the sample.

1.1.2. If possible, collect samples from the least contaminated sampling location (or background sampling location) to the most contaminated sampling location.

1.1.2.1. Collect the ambient or background samples first and store them in separate ice chests or shipping containers.

1.1.3. Collect samples in flowing water from downstream to upstream.

1.1.4. Do not store or ship highly contaminated samples (concentrated wastes, free product, etc.) or samples suspected of containing high concentrations of contaminants in the same ice chest or shipping container with other environmental samples.

1.1.4.1. Isolate these sample containers by sealing them in separate, untreated plastic bags immediately after collecting, preserving, labeling, etc.

1.1.4.2. Use a clean, untreated plastic bag to line the ice chest or shipping container.

2. SAMPLE COLLECTION ORDER

2.1. Sampling order is a recommendation to be modified depending on site circumstances. Unless field conditions justify other sampling regimens, collect samples in the following order:

- Volatile Organics and Volatile Inorganics
- Extractable Organics, Petroleum Hydrocarbons, Aggregate Organics and Oil & Grease
- Total Metals
- Dissolved Metals
- Inorganic Nonmetallics, Physical and Aggregate Properties, and Biologicals
- Radionuclides
- Microbiological

Note: If the pump used to collect groundwater samples cannot be used to collect volatile or extractable organics, then collect all other parameters, withdraw the pump and tubing, and collect the volatile and extractable organics.

3. COMPOSITE SAMPLES

- 3.1. Do not collect composite samples unless required by permit or DEP program.
- 3.2. If compositing is required, use the following procedure:
 - 3.2.1. Select sampling points from which to collect each aliquot.
 - 3.2.2. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.
 - 3.2.3. Record the approximate amount of each aliquot (volume or weight).
 - 3.2.4. Add preservative(s), if required.
 - 3.2.5. Label container and make appropriate field notes (see FD 1000-9000).
 - 3.2.6. Notify the laboratory that the sample is a composite sample.
 - 3.2.7. When collecting soil or sediment samples, combine the aliquots of the sample directly in the sample container with no pre-mixing. Notify the laboratory that the sample is an unmixed composite sample, and request that the laboratory thoroughly mix the sample before sample preparation or analysis.
 - 3.2.8. When collecting water composites see FS 2000, section 1.3 or pertinent sections of other water matrix SOPs for specific details on collection.

FS 1003. *Protective Gloves*

1. Gloves serve a dual purpose to:
 - Protect the sample collector from potential exposure to sample constituents
 - Minimize accidental contamination of samples by the collector
2. The DEP recommends wearing protective gloves when conducting all sampling activities. They must be worn except when:
 - The sample source is considered to be non-hazardous
 - The samples will not be analyzed for trace constituents
 - The part of the sampling equipment that is handled without gloves does not contact the sample source
3. Do not let gloves come into contact with the sample or with the interior or lip of the sample container.
4. Use clean, new, unpowdered and disposable gloves.
 - 4.1. DEP recommends latex gloves, however, other types of gloves may be used as long as the construction materials do not contaminate the sample or if internal safety protocols require greater protection.
 - 4.2. Note that certain materials (as might be potentially present in concentrated effluent) may pass through certain glove types and be absorbed in the skin. Many vendor catalogs provide information about the permeability of different gloves and the circumstances under which the glove material might be applicable.
 - 4.3. The powder in powdered gloves can contribute significant contamination and DEP does not recommend wearing powdered gloves unless it can be demonstrated that the powder does not interfere with the sample analysis.

5. If gloves are used, change:
 - After preliminary activities such as pump placement;
 - After collecting all the samples at a single sampling point; or
 - If torn, or used to handle extremely dirty or highly contaminated surfaces.
6. Properly dispose of all used gloves.

FS 1004. *Container and Equipment Rinsing*

When collecting aqueous samples, rinse the sample collection equipment with a portion of the sample water before taking the actual sample. Sample containers do not need to be rinsed. In the case of petroleum hydrocarbons, oil & grease or containers with premeasured preservatives, the sample containers cannot be rinsed.

FS 1005. *Fuel-Powered Equipment and Related Activities*

1. Place all fuel-powered equipment away from, and downwind of, any site activities (e.g., purging, sampling, decontamination). If field conditions preclude such placement (i.e., the wind is from the upstream direction in a boat), place the fuel source(s) as far away as possible from the sampling activities and describe the conditions in the field notes.
2. Handle fuel (i.e., filling vehicles and equipment) prior to the sampling day. If such activities must be performed during sampling, the personnel must wear disposable gloves. Dispense all fuels, dispose of gloves downwind, and well away from the sampling activities.
3. If sampling at active gas stations, stop sample collection activities during fuel deliveries.

FS 1006. *Preservation, Holding Times and Container Types*

1. Preserve all samples according to the requirements specified in Tables FS 1000-4 through FS 1000-10.
 - 1.1. The information listed in the above-referenced tables supersedes any preservation techniques, holding time or container type that might be discussed in individual analytical methods.
 - 1.2. If samples are collected only for total phosphorus and are not for NPDES compliance, thermal preservation (ice) is not required if the sample containers are pre-preserved with acid.
2. The preservation procedures in the referenced tables specify immediate preservation. "Immediate" is defined as "within 15 minutes of sample collection." Perform all preservation on-site (in the field).
 - 2.1. Preservation is not required if samples can be transported back to the laboratory within 15 minutes of collecting the sample and
 - 2.1.1. The laboratory begins sample analysis within the 15-minute window and documents the exact time the analysis began, or
 - 2.1.2. The laboratory adds the appropriate preservatives (including thermal preservation) within 15 minutes of sample collection and documents the exact time that the preservation was done.
3. PRESERVING COMPOSITE WATER SAMPLES

3.1. If the sample preservation requires thermal preservation (e.g., $<6^{\circ}\text{C}$), the samples must be cooled to the specified temperature.

3.1.1. Manually collected samples to be composited must be refrigerated at a temperature equal to or less than the required temperature.

3.1.2. Automatic samplers must be able to maintain the required temperature by packed ice or refrigeration.

3.2. When chemical preservation is also required, begin the preservation process within 15 minutes of the last collected sample.

3.3. Holding Times for Automatic Samplers:

3.3.1. If the collection period is 24 hours or less, the holding time begins at the last scheduled sample collection;

3.3.2. If the collection period exceeds 24 hours, the holding time begins with the time that the first sample is collected.

4. PH ADJUSTED PRESERVATION - Check the pH of pH-adjusted samples according to these frequencies:

4.1. During the first sampling event at a particular site, check all samples (includes each groundwater monitoring well, surface water location, or influent/effluent sampling location) that are pH-adjusted except volatile organics.

4.2. During subsequent visits to a particular site, check at least one sample per parameter group that must be pH-adjusted.

4.3. If the frequency of sample collection at a specified location is greater than once per month (i.e., weekly or daily), check the pH of at least one sample per parameter group (except volatile organics) according to the following schedule:

4.3.1. Weekly sampling: 1 pH check per month

4.3.2. Daily sampling: 1 pH check per week

4.4. If the frequency of sample collection at a specified location is once per month, check the pH of at least one sample per parameter group (except volatile organics) quarterly.

4.5. If site conditions vary from sampling event to sampling event, perform pH checks at increased intervals.

5. THERMAL PRESERVATION

5.1. When preservation requirements indicate cooling to a specific temperature, samples must be placed in wet ice within 15 minutes of sample collection (see 1006, section 2 above). Unless specified, do not freeze samples.

5.2. All supplies (ice, dry ice, etc.) necessary to meet a thermal preservation requirement must be onsite for immediate use.

5.3. Ship samples in wet ice. If samples are cooled to the required temperature before shipment, samples may be shipped with frozen ice packs if the specified temperature is maintained during shipment. The sample temperature must not exceed the specified temperature.

5.4. If immediate freezing is required, dry ice must be available in the field to begin the freezing process.

FS 1007. *Preventive and Routine Maintenance*

Preventive maintenance activities are necessary to ensure that the equipment can be used to obtain the expected results and to avoid unusable or broken equipment while in the field. Equipment is properly maintained when:

- It functions as expected during mobilization; and
- It is not a source of sample contamination (e.g., dust).

1. Follow the manufacturer's suggested maintenance activities and document all maintenance. At a minimum, DEP recommends the activities listed on Table FS 1000-12.

2. Maintain documentation for the following information for each piece of equipment or instrumentation. See FD 3000 also.

2.1. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit employed. This identifier may include a manufacturer name, model number, serial number, inventory number or other unique identification.

2.2. Log all maintenance and repair performed for each instrument unit, including routine cleaning procedures and solution or parts replacement for instrument probes.

2.3. Include the calendar date for the procedures performed.

2.4. Record names of personnel performing the maintenance or repair tasks.

2.5. Describe any malfunctions necessitating repair or service.

2.6. Retain vendor service records for all affected instruments.

2.7. Record the following for rented equipment:

- Rental date(s)
- Equipment type and model or inventory number or other description

2.8. Retain the manufacturer's operating and maintenance instructions.

FS 1008. *Documentation and References*

1. REFERENCES: All sampling references must be available for consultation in the field. These include:

- DEP SOPs;
- Internal SOPs;
- Sampling and analysis plans; and/or
- Quality Assurance Project Plans.

2. DOCUMENTATION: Complete and sign all documentation (see FD 1000).

FS 1009. *Sample Documentation and Evidentiary Custody*

1. SAMPLE DOCUMENTATION

1.1. Document all activities related to a sampling event, including sample collection, equipment calibration, equipment cleaning and sample transport.

1.2. The required documentation related to each sampling or other field activity is specified in the associated SOPs; i.e., FQ 1000, FC 1000, the FS series, and the FT series.

1.3. The documentation requirements are also summarized in FD 1000, Field Documentation. FD 1000 additionally contains a list of example forms published with the SOPs that may be used to document various activities or as templates for creating customized forms.

2. LEGAL CHAIN OF CUSTODY (COC)

The use of legal or evidentiary Chain-of-Custody (COC) protocols is not usually required by DEP, except for cases involving civil or criminal enforcement. Do not use these procedures for routine sampling for compliance unless evidentiary custody protocols are specifically mandated in a permit or other legal order or when required for enforcement actions.

Evidentiary sample custody protocols are used to demonstrate that the samples and/or sample containers were handled and transferred in such a manner as to eliminate possible tampering.

When a client or situation requires legal COC, use the procedures in FD 7000 to document and track all time periods associated with the physical possession and storage of sample containers, samples, and subsamples from point of origin through the final analytical result and sample disposal.

When legal or evidentiary COC is required, samples must be:

- In the actual possession of a person who is authorized to handle the samples (e.g., sample collector, laboratory technician);
- In the view of the same person after being in their physical possession;
- Secured by the same person to prevent tampering; or
- Stored in a designated secure area.

2.1. Control and document access to all evidentiary samples and subsamples with adequate tracking. Documentation must include records about each of the activities and situations listed below, when applicable to sample evidence, and must track the location and physical handling of all samples by all persons at all times.

2.1.1. Limit the number of individuals who physically handle the samples as much as practicable.

2.1.2. When storing samples and subsamples, place samples in locked storage (e.g., locked vehicle, locked storeroom, etc.) at all times when not in the possession or view of authorized personnel.

2.1.3. Alternatively, maintain restricted access to facilities where samples are stored. Ensure that unauthorized personnel are not able to gain access to the samples at any time.

2.1.4. Do not leave samples in unoccupied motel or hotel rooms or other areas where access cannot be controlled by the person(s) responsible for custody without first securing samples and shipping or storage containers with tamper-indicating evidence tape or custody seals. Ice chests or other storage containers used to store sample containers in hotel rooms may be sealed instead of sealing each sample container stored within.

2.2. Use a Chain of Custody form or other transmittal record to document sample transfers to other parties. Other records and forms may be used to document internal activities if they meet the requirements for legal chain of custody.

2.3. Legal COC begins when the precleaned sample containers are dispatched to the field.

2.3.1. The person who relinquishes the prepared sample kits or containers and the individual who receives the sample kits or containers must sign the COC form unless the same party provides the containers and collects the samples.

2.3.2. All parties handling the empty sample containers and samples are responsible for documenting sample custody, including relinquishing and receiving samples, except commercial common carriers.

2.4. Shipping Samples under Legal COC

2.4.1. Complete all relevant information on the COC transmittal form or record (see FD 7200, section 2).

2.4.2. Internal records must document the handling of the samples and shipping containers in preparation for shipment. The names of all persons who have prepared the shipment must be recorded. All time intervals associated with handling and preparation must be accounted for.

2.4.3. Place the forms in a sealed waterproof bag and place in the shipping container with the samples.

2.4.4. Seal the shipping container with tamper-proof seals (see 2.6 below) so that any tampering can be clearly seen by the individual who receives the samples.

2.4.5. Note: The common carrier does not sign COC records. However, the common carrier (when used) must be identified.

2.5. Delivering Samples to the Laboratory

2.5.1. All individuals who handle and relinquish the sample containers must sign the transmittal form. The legal custody responsibilities of the field operations end when the samples are relinquished to the laboratory.

2.6. Chain of Custody Seals: If required, affix tamper-indicating evidence tape or seals to all sample, storage and shipping container closures when transferring or shipping sample container kits or samples to another party.

2.6.1. Place the seal so that the closure cannot be opened without breaking the seal.

2.6.2. Record the time, calendar date and signatures of responsible personnel affixing and breaking all seals for each sample container and shipping container.

2.6.3. Affix new seals every time a seal is broken until continuation of evidentiary custody is no longer required.

FS 1010. *Health and Safety*

Implement all local, state and federal requirements relating the health and safety.

FS 1011. *Hazardous Wastes*

Follow all local, state and federal requirements pertaining to the storage and disposal of any hazardous or investigation-derived wastes.

1. Properly manage all investigation-derived waste (IDW) so contamination is not spread into previously uncontaminated areas.
 - 1.1. IDW includes all water, soil, drilling mud, decontamination wastes, discarded personal protective equipment (PPE), etc. from site investigations, exploratory borings, piezometer and monitoring well installation, refurbishment, and abandonment, and other investigative activities. Containerize the IDW at the time it is generated.
 - 1.2. Determine if the IDW must be managed as Resource Conservation and Recovery Act (RCRA) regulated hazardous waste through appropriate testing or generator knowledge. Manage all IDW that is determined to be RCRA regulated hazardous waste according to the local state and federal requirements.
 - 1.3. Properly dispose of IDW that is not a RCRA-regulated hazardous waste but is contaminated above the Department's Soil Cleanup Target Levels or the state standards and/or minimum criteria for ground water quality.
 - 1.4. IDW that is not contaminated or contains contaminants below the Department's Soil Cleanup Target Levels or the state standards and/or minimum criteria for ground water quality may be disposed of onsite as long as the IDW will not cause a surface water violation.
 - 1.5. Maintain all containers holding IDW in good condition:
 - 1.5.1. Periodically inspect the containers for damage
 - 1.5.2. Ensure that all required labeling (DOT, RCRA, etc.) are clearly visible.

Appendix FS 1000
Tables, Figures and Forms

Table FS 1000-1	Equipment Construction Materials
Table FS 1000-2	Construction Material Selection for Equipment and Sample Containers
Table FS 1000-3	Equipment Use and Construction
Table FS 1000-4	40 CFR Part 136 Table II: Required Containers, Preservation Techniques, and Holding Times (Water/Wastewater Samples)
Table FS 1000-5	Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times for Analytes not found in 40 CFR Part 136
Table FS 1000-6	Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples.
Table FS 1000-7	Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035
Table FS 1000-8	Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II
Table FS 1000-9	Containers, Preservation and Holding Times for Biosolids Samples and Protozoans
Table FS 1000-10	Container Materials, Preservation, and Holding Times for Fish and Shellfish
Table FS 1000-11	Holding Times for SPLP or TCLP Extraction, Sample Preparation and Determinative Analysis
Table FS 1000-12	Preventive Maintenance Tasks
Figure FS 1000-1	Organic Trap Configuration for Collecting Extractable Organics with a Peristaltic Pump

DEP-SOP-001/01
FS 1000 General Sampling Procedures
Table FS 1000-1
Equipment Construction Materials

Construction Material ¹	Acceptable Analyte Groups	Precautions
Metals		
316 Stainless Steel	All analyte groups. Recommended for inorganic nonmetallics, metals, volatile and extractable organics.	Do not use if weathered, corroded or pitted. ²
300-Series Stainless Steel (304, 303, 302)	Suitable for all analyte groups (if used, check for corrosion before use). Recommended for inorganic nonmetallics, metals, volatile and extractable organics.	Do not use if weathered, corroded or pitted. ² If corroded, there is a potential for samples to be contaminated with iron, chromium, copper or nickel. Check for compatibility with water chemistry for dedicated applications. Do not use in low pH, high chloride, or high TDS waters.
Low Carbon Steel Galvanized Steel Carbon Steel	Inorganic nonmetallics only.	Coring devices are acceptable for all analyte groups if appropriate liners are used. Use Teflon liners for organics. Use plastic or Teflon liners for metals. Do not use if weathered, corroded or pitted. ² If corroded, there is a potential for samples to be contaminated with iron and manganese. Galvanized equipment will also contaminate with zinc and cadmium. If used to collect large samples (e.g., dredges), collect organic and metal samples may be collected from portions of the interior of the collected material.
Brass	Inorganic nonmetallics only.	Do not use if weathered, corroded or pitted. ²
Plastics³		
Teflon and other fluorocarbon polymers	All analyte groups. Especially recommended for trace metals and organics.	Easily scratched. Do not use if scratched or discolored.
Polypropylene Polyethylene (All Types)	All analyte groups.	Easily scratched. Do not use if scratched or discolored.
Polyvinyl chloride (PVC)	All analyte groups except extractable and volatile organics.	Do not use when collecting extractable or volatile organics samples.

DEP-SOP-001/01
FS 1000 General Sampling Procedures
Table FS 1000-1
Equipment Construction Materials

Construction Material¹	Acceptable Analyte Groups	Precautions
Tygon, Silicone, Neoprene	All analyte groups except extractable and volatile organics.	Do not use when collecting extractable or volatile organic samples. Do not use silicone if sampling for silica.
Viton	All analyte groups except extractable and volatile organics. ⁴	Minimize contact with sample. Use only if no alternative material exists.
Glass		
Glass, borosilicate	All analyte groups except silica and boron.	

Adapted from USGS Field Manual, Chapter 2, January 2000.

¹ Refers to construction material of the portions of the sampling equipment that come in contact with the sample (e.g., housing of variable speed submersible pump must be stainless steel if extractable organics are sampled; the housing of a variable speed submersible pump used to sample metals may be plastic.)

² Corroded/weathered surfaces are active sorption sites for organic compounds.

³ Plastics used in connection with inorganic trace element samples (including metals) must be uncolored or white.

⁴ May be allowable for specialized parts where no alternative material exists (e.g., Viton seals are the best available seal for some dedicated pump systems), however, contact with the sample must be minimized.

Table FS 1000-2
Construction Material Selection for Equipment and Sample Containers

Analyte Group	Acceptable Materials
Extractable Organics	Teflon Stainless steel Glass Polypropylene (All types) Polyethylene (All types) All parts of the system including connectors and gaskets must be considered – Viton may be used if no other material is acceptable.
Volatile Organics	Teflon Stainless steel Glass Polypropylene (All types) Polyethylene (All types) All parts of the system including connectors and gaskets must be considered – Viton may be used if no other material is acceptable.
Metals	Teflon Stainless steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass (except silica and boron)
Ultratrace Metals	Teflon Polyethylene (All types) Polypropylene (All types) Polycarbonate Mercury must be in glass or Teflon
Inorganic Nonmetallics	Teflon Stainless steel Low carbon, Galvanized or Carbon steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass Brass

Table FS 1000-2
Construction Material Selection for Equipment and Sample Containers

Analyte Group	Acceptable Materials
Microbiological samples	Teflon Stainless steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass Sterilize all sample containers. Thoroughly clean sampling equipment and rinse several times with sample water before collection. Sampling equipment does not require sterilization Do not rinse sample containers

Table FS 1000-3
Equipment Use and Construction

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>	<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING</u> ¹	<u>TUBING</u>		
WATER SAMPLING				
GROUNDWATER				
1 Positive displacement pumps ²				
a. Submersible (turbine, helical rotor, gear driven)	SS, Teflon	SS, Teflon, PE, PP	Purging	3,4,5; must be variable speed
			Sampling	3,4,5 must be variable speed
	SS, Teflon	Non-inert ⁶	Purging	3,4,5 must be variable speed; polishing required ⁷
			Sampling	Must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
	Non-inert ⁶	Non-inert ⁶	Purging	3,4,5 must be variable speed; polishing required ⁷
			Sampling	Must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
b. Bladder pump (no gas contact)	SS, Teflon, PE, PP or PVC if permanently installed	SS, Teflon, PE, PP	Purging	3,4,5 must be variable speed
			Sampling	3,4 must be variable speed Bladder must be Teflon if sampling for volatile or extractable organics or PE or PP if used in portable pumps
	SS, Teflon, PE, PP	Non-inert ⁶	Purging	3,4 must be variable speed; polishing required ⁷
			Sampling	This configuration is not recommended 3,4 must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
	Non-inert ⁶	Non-inert ⁶	Purging	3,4 must be variable speed; polishing required ⁷
			Sampling	3,4 must be variable speed; polishing required ⁷ If sampling for metals, the tubing must be non-metallic if not SS

Table FS 1000-3
Equipment Use and Construction

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u> ¹	<u>TUBING</u>	<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
2. Suction lift pumps					
a. Centrifugal	N/A	SS, Teflon, PE, PP	Purging	All analyte groups	⁴ foot-valve required Must be variable speed
	N/A	Non-inert ⁶	Purging	All analyte groups	⁴ foot-valve required; polishing required/ Must be variable speed
b. Peristaltic	N/A	SS, Teflon, PE, PP	Purging	All analyte groups	⁴ foot-valve required; polishing required/ or continuous pumping required Must be variable speed
			Sampling	All analyte groups <u>except</u> volatile organics	⁴ Silicone tubing in pump head Must be variable speed
	N/A	Non-inert ⁶	Purging	All analyte groups	⁴ foot-valve required Must be variable speed
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	⁴ Silicone tubing in pump head Must be variable speed
3. Bailers	SS, Teflon, PE, PP	N/A	Purging	All analyte groups	None; <u>not recommended</u>
			Sampling	All analyte groups	None; <u>not recommended</u>
	Non-inert ⁶	N/A	Purging	All analyte groups <u>except</u> volatile and extractable organics	None; <u>not recommended</u> If sampling for metals, the tubing must be non-metallic if not SS
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	None; <u>not recommended</u> If sampling for metals, the tubing must be non-metallic if not SS
<u>SURFACE WATER</u>					
1. Intermediate containers such as pond sampler, scoops, beakers, buckets, and dippers	SS, Teflon, Teflon-coated, PE, PP	N/A	Grab sampling	All analyte groups	None
	Glass	N/A		All analyte groups except boron and fluoride	None
	Non-inert ⁶	N/A		All analyte groups <u>except</u> volatile and extractable organics	None

Table FS 1000-3
Equipment Use and Construction

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>	<u>TUBING</u>	<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING¹</u>				
2. Nansen, Kemmerer, Van Dorn, Alpha and Beta Samplers, Niskin (or equivalent)	SS, Teflon, Teflon-coated, PE, PP	N/A	Specific depth grab sampling	All analyte groups	None
	Non-inert ⁶	N/A		All analyte groups <u>except</u> volatile and extractable organics	None
3. DO Dunker	SS, Teflon, glass, PE, PP	N/A	Water column composite sampling	All analyte groups	None
4. Bailers – double valve	SS, Teflon, PE, PP	N/A	Grab sampling	All analyte groups	None
	Non-inert ⁶	N/A	Grab sampling	All analyte groups <u>except</u> volatile and extractable organics	None If sampling for metals, the tubing must be non-metallic if not SS
5. Peristaltic pump	N/A	SS, Teflon, PE, PP	Specific depth sampling	All analyte groups <u>except</u> volatile organics	Silicone tubing in pump head Must be variable speed
	N/A	Non-inert ⁶		All analyte groups <u>except</u> volatile and extractable organics	Silicone tubing in pump head Must be variable speed
<u>FIELD FILTRATION UNITS</u>	N/A		Dissolved constituents	Inorganic nonmetallics and metals in surface water Inorganic nonmetallics in groundwater Metals in groundwater and static wastewater and surface water Metals in moving surface water (i.e., river/stream)	Must use a 0.45 µm filter Must use a 0.45 µm filter Must use in-line, high capacity, one-piece molded filter that is connected to the outlet of a pump; no intermediate vessels; positive pressure PE, PP & Teflon bailers acceptable Must use a 1 µm filter in groundwater, a 0.45 µm filter in surface water Must use positive pressure device, but an intermediate vessel may be used. Use a 0.45 µm filter

Table FS 1000-3
Equipment Use and Construction

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u> <u>HOUSING</u> ¹	<u>TUBING</u>	<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
SOLID SAMPLING					
SOILS					
1. Core barrel (or liner)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups ⁸	9, 10, 11
	Non-inert ⁶ nonmetallics	N/A	Sampling	All analyte groups	12
	Non-inert ⁶ metals	N/A	Sampling	All analyte groups	12
2. Trowel, scoop, spoon or spatula	SS, Teflon, Teflon-coated, PE, PP	N/A	Sampling	All analyte groups ⁸	
			Compositing	All analyte groups except volatile organics	Samples for volatile organics must grab samples
	Plastic	N/A	Sampling and compositing	All analyte groups <u>except</u> volatile and extractable organics	None Must be nonmetallic if not SS
3. Mixing tray (pan)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups ⁸	11
			Compositing or homogenizing	All analyte groups except volatile organics	11
	Non-inert ⁶	N/A	Compositing or homogenizing	All analyte groups	10, 11, 12 must be nonmetallic if not SS
4. Shovel, bucket auger	SS	N/A	Sampling	All analyte groups ⁸	None
	Non-SS	N/A	Sampling	All analyte groups ⁸	10, 11, 12
5. Split spoon	SS or carbon steel w/ Teflon insert	N/A	Sampling	All analyte groups ⁸	10, 11, 12
6. Shelby tube	SS	N/A	Sampling	All analyte groups ⁸	9
	Carbon steel	N/A	Sampling	All analyte groups	9, 10, 12
SEDIMENT					
1. Coring devices	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups ⁸	9, 10, 11

DEP-SOP-001/01
FS 1000 General Sampling Procedures

Table FS 1000-3
Equipment Use and Construction

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u> <u>HOUSING</u> ¹	<u>TUBING</u>	<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	Non-inert ⁶ nonmetallics	N/A	Sampling	All analyte groups	¹²
	Non-inert ⁶ metals	N/A	Sampling	All analyte groups	^{9,10,11}
2. Grab – Young, Petersen, Shipek	Teflon, Teflon-lined, SS	N/A	Sampling	All analyte groups ⁸	None
	Carbon steel	N/A	Sampling	All analyte groups	^{10,11}
3. Dredges – Eckman, Ponar, Petit Ponar Van Veen	SS	N/A	Sampling	All analyte groups ⁸	None
	Carbon steel, brass	N/A	Sampling	All analyte groups	^{10,11}
4. Trowel, scoop, spoon or spatula	SS, Teflon, Teflon-coated, PE, PP	N/A	Sampling	All analyte groups ⁸	
			Compositing	All analyte groups except volatile organics	Samples for volatile organics be grab samples
	Plastic	N/A	Sampling and compositing	All analyte groups <u>except</u> volatile and extractable organics	None must be nonmetallic if not SS
5. Mixing tray (pan)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups ⁸	¹¹
			Compositing or homogenizing	All analyte groups except volatile organics	¹¹
	Non-inert ⁶	N/A	Compositing or homogenizing	All analyte groups <u>except</u> volatile and extractable organics	none ¹¹ must be nonmetallic if not SS
WASTE ¹³					
Scoop	SS	N/A	Liquids, solids & sludges	All analyte groups ⁸	Cannot collect deeper phases
Spoon	SS	N/A	Solids, sludges	All analyte groups ⁸	Cannot collect deeper phases
Push tube	SS	N/A	Solids, sludges	All analyte groups ⁸	Cannot collect deeper phases
Auger	SS	N/A	Solids	All analyte groups ⁸	None

Table FS 1000-3
Equipment Use and Construction

<u>EQUIPMENT</u>	<u>CONSTRUCTION</u>		<u>USE</u>	<u>PERMISSIBLE ANALYTE GROUPS</u>	<u>RESTRICTIONS AND PRECAUTIONS</u>
	<u>HOUSING</u> ¹	<u>TUBING</u>			
Sediment sampler	SS	N/A	Impoundments, piles	All analyte groups ⁸	None
Ponar dredge	SS	N/A	Solids, sludges & sediments	All analyte groups ⁸	None
Coliwasa, Drum thief	Glass	N/A	Liquids, sludges	All analyte groups	None
Mucksucker, Dipstick	Teflon		Liquids, sludges	All analyte groups	Not recommended for tanks > 11 feet deep
Bacon bomb	SS	N/A	Liquids	All analyte groups ⁸	Not recommended for viscous wastes
Bailer	SS, Teflon	N/A	Liquids	All analyte groups ⁸	Do not use with heterogeneous wastes Not recommended for viscous wastes
Peristaltic pump	N/A	Teflon, Glass	Liquids	All analyte groups except volatile organics	Do not use in flammable atmosphere Not recommended for viscous wastes
Backhoe bucket	Steel	N/A	Solids, Sludges		Difficult to clean Volatiles and metals must be taken from the interior part of the sample
Split spoon	SS	N/A	Solids	All analyte groups ⁸	
Roto-Hammer	Steel	N/A	Solids	All analyte groups ⁸	Physically breaks up sample Not for flammable atmospheres

Acronyms:

N/A not applicable
SS stainless steel
HDPE high-density polyethylene
PE polyethylene
PVC polyvinyl chloride
PP polypropylene

Table FS 1000-3
Equipment Use and Construction

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- ¹ Refers to tubing and pump housings/internal parts that are in contact with purged or sampled water (interior and exterior of delivery tube, inner lining of the discharge tube, etc.).
- ² If used to collect volatile or extractable organics, all power cords and other tubing must be encased in Teflon, PE or PP.
- ³ If used as a non-dedicated system, pump must be completely disassembled, if practical, and cleaned between wells.
- ⁴ Delivery tubing must be precleaned and precut at the base of operations or laboratory. If the same tubing is used during the sampling event, it must be cleaned and decontaminated between uses.
- ⁵ In-line check valve required.
- ⁶ "Non-inert" pertains to materials that are reactive (adsorb, absorb, etc.) to the analytes being sampled. For organics, materials include rubber, plastics (except PE and PP), and PVC. For metals, materials include brass, galvanized, and carbon steel.
- ⁷ "Polishing": When purging for volatile or extractable organics, the entire length of tubing or the portion which comes in contact with the formation water must be constructed of Teflon, SS, PE or PP. If other materials (e.g., PVC, garden hoses, etc.) are used, the following protocols must be followed: 1) slowly withdraw the pump from the water column during the last phase of purging, to remove any water from the well that may have contacted the exterior of the pump and/or tubing; 2) remove a single well volume with the sampling device before sampling begins. **Do not use Tygon** for purging if purgeable or extractable organics are of interest. Polishing **is not recommended**; use of sampling equipment constructed of appropriate materials is preferred.
- ⁸ Do not use if collecting for hexavalent chromium (Chromium⁺⁶)
- ⁹ If samples are sealed in the liner for transport to the laboratory, the sample for VOC analysis must be taken from the interior part of the core.
- ¹⁰ If a non-stainless steel (carbon steel, aluminum) liner, core barrel or implement is used, take the samples for metals, purgeable organics and organics from the interior part of the core sample.
- ¹¹ Aluminum foil, trays or liners may be used only if aluminum is not an analyte of interest.
- ¹² If non-inert-liner, core barrel or implement is used, take samples from the interior part of the collected sample.
- ¹³ If disposable equipment of alternative construction materials is used, the construction material must be compatible with the chemical composition of the waste, cannot alter the characteristics of the waste sample in any way, and cannot contribute analytes of interest or any interfering components.

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
Table IA—Bacterial Tests:			
1–5. Coliform, total, fecal, and <i>E. coli</i>	PA, G	Cool, <10 °C, 0.0008% Na ₂ S ₂ O ₃ ⁵	6 hours ^{6, 7}
6. Fecal streptococci	PA, G	Cool, <10 °C, 0.0008% Na ₂ S ₂ O ₃ ⁵	6 hours ⁶
7. Enterococci	PA, G	Cool, <10 °C, 0.0008% Na ₂ S ₂ O ₃ ⁵	6 hours ⁶
8. Salmonella	PA, G	Cool, <10 °C, 0.0008% Na ₂ S ₂ O ₃ ⁵	6 hours ⁶
Table IA— Aquatic Toxicity Tests:			
9–11. Toxicity, acute and chronic	P, FP, G	Cool, ≤6 °C ⁸	36 hours
Table IB—Inorganic Tests:			
1. Acidity	P, FP, G	Cool, ≤6 °C ⁹	14 days
2. Alkalinity	P, FP, G	Cool, ≤6 °C ⁹	14 days
4. Ammonia	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
9. Biochemical oxygen demand	P, FP, G	Cool, ≤6 °C ⁹	48 hours
10. Boron	P, FP, or Quartz	HNO ₃ to pH<2	6 months
11. Bromide	P, FP, G	None required	28 days
14. Biochemical oxygen demand, carbonaceous	P, FP, G	Cool, ≤6 °C ⁹	48 hours
15. Chemical oxygen demand	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
16. Chloride	P, FP, G	None required	28 days
17. Chlorine, total residual	P, G	None required	Analyze within 15 minutes
21. Color	P, FP, G	Cool, ≤6 °C ⁹	48 hours
23–24. Cyanide, total or available (or CATC)	P, FP, G	Cool, ≤6 °C ⁹ , NaOH to pH>12 ¹⁰ , reducing agent ⁵	14 days
25. Fluoride	P	None required	28 days
27. Hardness	P, FP, G	HNO ₃ or H ₂ SO ₄ to pH<2	6 months
28. Hydrogen ion (pH)	P, FP, G	None required	Analyze within 15 minutes
31, 43. Kjeldahl and organic N	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
Table IB—Metals:			
7 18. Chromium VI	P, FP, G	Cool, ≤6 °C ⁹ , pH = 9.3–9.7 ¹²	28 days
35. Mercury (CVAA)	P, FP, G	HNO ₃ to pH<2	28 days

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
35. Mercury (CVAFS)	FP, G; and FP-lined cap ¹³	5 mL/L 12N HCl or 5 mL/L BrCl ¹³	90 days ¹³
3, 5–8, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70– 72, 74, 75. Metals, except boron, chromium VI, and mercury.	P, FP, G	HNO ₃ to pH<2, or at least 24 hours prior to analysis ¹⁴	6 months
38. Nitrate	P, FP, G	Cool, ≤6 °C ⁹	48 hours
39. Nitrate-nitrite	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
40. Nitrite	P, FP, G	Cool, ≤6 °C ⁹	48 hours
41. Oil and grease	G	Cool, ≤6 °C ⁹ , HCl or H ₂ SO ₄ to pH<2	28 days
42. Organic Carbon	P, FP, G	Cool, ≤6 °C ⁹ , HCl, H ₂ SO ₄ , or H ₃ PO ₄ to pH<2.	28 days
44. Orthophosphate	P, FP, G	Cool, ≤6 °C ⁹	Filter within 15 minutes; Analyze within 48 hours
46. Oxygen, Dissolved Probe	G, Bottle and top	None required	Analyze within 15 minutes
47. Winkler	G, Bottle and top	Fix on site and store in dark	8 hours
48. Phenols	G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
49. Phosphorous (elemental)	G	Cool, ≤6 °C ⁹	48 hours
50. Phosphorous, total	P, FP, G	Cool, ≤6 °C ⁹ , H ₂ SO ₄ to pH<2	28 days
53. Residue, total	P, FP, G	Cool, ≤6 °C ⁹	7 days
54. Residue, Filterable	P, FP, G	Cool, ≤6 °C ⁹	7 days
55. Residue, Nonfilterable (TSS)	P, FP, G	Cool, ≤6 °C ⁹	7 days
56. Residue, Settleable	P, FP, G	Cool, ≤6 °C ⁹	48 hours
57. Residue, Volatile	P, FP, G	Cool, ≤6 °C ⁹	7 days
61. Silica	P or Quartz	Cool, ≤6 °C ⁹	28 days
64. Specific conductance	P, FP, G	Cool, ≤6 °C ⁹	28 days
65. Sulfate	P, FP, G	Cool, ≤6 °C ⁹	28 days
66. Sulfide	P, FP, G	Cool, ≤6 °C ⁹ , add zinc acetate plus sodium hydroxide to pH>9	7 days
67. Sulfite	P, FP, G	None required	Analyze within 15 minutes
68. Surfactants	P, FP, G	Cool, ≤6 °C ⁹	48 hours

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
69. Temperature	P, FP, G	None required	Analyze
73. Turbidity	P, FP, G	Cool, ≤6 °C ⁹	48 hours

Table IC—Organic Tests 8			
13, 18–20, 22, 24–28, 34–37, 39–43, 45–47, 56, 76, 104, 105, 108–111, 113. Purgeable Halocarbons	G, FP-lined septum	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵	14 days
6, 57, 106. Purgeable aromatic hydrocarbons	G, FP-lined septum	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵ , HCl to pH 2 ¹⁶	14 days ¹⁶
3, 4. Acrolein and acrylonitrile	G, FP-lined septum	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵ , pH to 4–5 ¹⁷	14 days ¹⁷
23, 30, 44, 49, 53, 77, 80, 81, 98, 100, 112. Phenols ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
7, 38. Benzidines ^{18,19}	G, FP-lined cap	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction ²⁰
14, 17, 48, 50–52. Phthalate esters ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹	7 days until extraction, 40 days after extraction
82–84. Nitrosamines ^{18,21}	G, FP-lined cap	Cool, ≤6 °C ⁹ , store in dark, 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
88–94. PCBs ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹	1 year until extraction, 1 year after extraction
54, 55, 75, 79. Nitroaromatics and isophorone ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , store in dark, 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
1, 2, 5, 8–12, 32, 33, 58, 59, 74, 78, 99, 101. Polynuclear aromatic hydrocarbons ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , store in dark, 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
15, 16, 21, 31, 87. Haloethers ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵	7 days until extraction, 40 days after extraction
29, 35–37, 63–65, 107. Chlorinated hydrocarbons ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹	7 days until extraction, 40 days after extraction
60–62, 66–72, 85, 86, 95–97, 102, 103. CDDs/CDFs ¹⁸			
Aqueous Samples: Field and Lab Preservation	G	Cool, ≤6 °C ⁹ , 0.008% Na ₂ S ₂ O ₃ ⁵ , pH<9	1 year

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to all Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
Solids and Mixed-Phase Samples: Field Preservation	G	Cool, ≤6 °C ⁹	7 days
Tissue Samples: Field Preservation	G	Cool, ≤6 °C ⁹	24 hours
Solids, Mixed-Phase, and Tissue Samples: Lab Preservation	G	Freeze, ≤-10 °C	1 year
Table ID—Pesticides			
Tests: 1–70. Pesticides ¹⁸	G, FP-lined cap	Cool, ≤6 °C ⁹ , pH 5–9 ²²	7 days until extraction, 40 days after extraction
Table IE—Radiological Tests:			
1–5. Alpha, beta, and radium	P, FP, G	HNO ₃ to pH<2	6 months
Table IH—Bacterial Tests:			
1. <i>E. coli</i>			
2. Enterococci	PA, G	Cool, <10 °C, 0.008% Na ₂ S ₂ O ₃ ⁵	6 hours ⁶
Table IIH—Protozoan Tests:			
8. Cryptosporidium	LDPE; field filtration	0–8 °C	96 hours. ²³
9. Giardia	LDPE; field filtration	0–8 °C	96 hours ²³

Reference: This table is adapted from Table II, 40 CFR Part 136, 2007

¹ “P” is polyethylene; “FP” is fluoropolymer (polytetrafluoroethylene (PTFE; Teflon®), or other fluoropolymer, unless stated otherwise in this Table II; “G” is glass; “PA” is any plastic that is made of a sterilizable material (polypropylene or other autoclavable plastic); “LDPE” is low density polyethylene.

² Except where noted in this Table II and the method for the parameter, preserve each grab sample within 15 minutes of collection. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), refrigerate the sample at ≤6 °C during collection unless specified otherwise in this Table II or in the method(s). For a composite sample to be split into separate aliquots for preservation and/or analysis, maintain the sample at ≤6 °C, unless specified otherwise in this Table II or in the method(s), until collection, splitting, and preservation is completed. Add the preservative to the sample container prior to sample collection when the preservative will not compromise the integrity of a grab sample, a composite sample, or an aliquot split from a composite sample; otherwise, preserve the grab sample, composite sample,

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times

Applicable to all Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

or aliquot split from a composite sample within 15 minutes of collection. If a composite measurement is required but a composite sample would compromise sample integrity, individual grab samples must be collected at prescribed time intervals (e.g., 4 samples over the course of a day, at 6-hour intervals). Grab samples must be analyzed separately and the concentrations averaged. Alternatively, grab samples may be collected in the field and composited in the laboratory if the compositing procedure produces results equivalent to results produced by arithmetic averaging of the results of analysis of individual grab samples. For examples of laboratory compositing procedures, see EPA Method 1664A (oil and grease) and the procedures at 40 CFR 141.34(f)(14)(iv) and (v) (volatile organics).

³ When any sample is to be shipped by common carrier or sent via the U.S. Postal Service, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO₃) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H₂SO₄) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

⁴ Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before the start of analysis and still be considered valid (e.g., samples analyzed for fecal coliforms may be held up to 6 hours prior to commencing analysis). Samples may be held for longer periods only if the permittee or monitoring laboratory has data on file to show that, for the specific types of samples under study, the analytes are stable for the longer time, and has received a variance from the Regional Administrator under § 136.3(e). For a grab sample, the holding time begins at the time of collection. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), the holding time begins at the time of the end of collection of the composite sample. For a set of grab samples composited in the field or laboratory, the holding time begins at the time of collection of the last grab sample in the set. Some samples may not be stable for the maximum time period given in the table. A permittee or monitoring laboratory is obligated to hold the sample for a shorter time if it knows that a shorter time is necessary to maintain sample stability. See § 136.3(e) for details. The date and time of collection of an individual grab sample is the date and time at which the sample is collected. For a set of grab samples to be composited, and that are all collected on the same calendar date, the date of collection is the date on which the samples are collected. For a set of grab samples to be composited, and that are collected across two calendar dates, the date of collection is the dates of the two days; e.g., November 14–15. For a composite sample collected automatically on a given date, the

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to all Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

date of collection is the date on which the sample is collected. For a composite sample collected automatically, and that is collected across two calendar dates, the date of collection is the dates of the two days; e.g., November 14–15.

⁵ Add a reducing agent only if an oxidant (e.g., chlorine) is present. Reducing agents shown to be effective are sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$), ascorbic acid, sodium arsenite (NaAsO_2), or sodium borohydride (NaBH_4). However, some of these agents have been shown to produce a positive or negative cyanide bias, depending on other substances in the sample and the analytical method used. Therefore, do not add an excess of reducing agent. Methods recommending ascorbic acid (e.g., EPA Method 335.4) specify adding ascorbic acid crystals, 0.1–0.6 g, until a drop of sample produces no color on potassium iodide (KI) starch paper, then adding 0.06 g (60 mg) for each liter of sample volume. If NaBH_4 or NaAsO_2 is used, 25 mg/L NaBH_4 or 100 mg/L NaAsO_2 will reduce more than 50 mg/L of chlorine (see method “Kelada-01” and/or Standard Method

4500–CN⁻ for more information). After adding reducing agent, test the sample using KI paper, a test strip (e.g. for chlorine, SenSafe™ Total Chlorine Water Check 480010) moistened with acetate buffer solution (see Standard Method 4500–Cl.C.3e), or a chlorine/oxidant test method (e.g., EPA Method 330.4 or 330.5), to make sure all oxidant is removed. If oxidant remains, add more reducing agent. Whatever agent is used, it should be tested to assure that cyanide results are not affected adversely.

⁶ Samples analysis should begin immediately, preferably within 2 hours of collection. The maximum transport time to the laboratory is 6 hours, and samples should be processed within 2 hours of receipt at the laboratory.

⁷ For fecal coliform samples for sewage sludge (biosolids) only, the holding time is extended to 24 hours for the following sample types using either EPA Method 1680 (LTB–EC) or 1681 (A–1): Class A composted, Class B aerobically digested, and Class B anaerobically digested.

⁸ Sufficient ice should be placed with the samples in the shipping container to ensure that ice is still present when the samples arrive at the laboratory. However, even if ice is present when the samples arrive, it is necessary to immediately measure the temperature of the samples and confirm that the preservation temperature maximum has not been exceeded. In the isolated cases where it can be documented that this holding temperature cannot be met, the permittee can be given the option of on-site testing or can request a variance. The request for a variance should include supportive data which show that the toxicity of the effluent samples is not reduced because of the increased holding temperature.

⁹ Aqueous samples must be preserved at $\leq 6^\circ\text{C}$, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of “ $\leq 6^\circ\text{C}$ ” is used in place of the “ 4°C ” and “ $< 4^\circ\text{C}$ ” sample temperature requirements listed in some methods. It is not necessary to measure the sample temperature to three significant figures ($1/100^{\text{th}}$ of 1 degree); rather, three

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to all Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

significant figures are specified so that rounding down to 6 °C may not be used to meet the ≤6 °C requirement. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

¹⁰ Sample collection and preservation: Collect a volume of sample appropriate to the analytical method in a bottle of the material specified. If the sample can be analyzed within 48 hours and sulfide is not present, adjust the pH to > 12 with sodium hydroxide solution (e.g., 5% w/v), refrigerate as specified, and analyze within 48 hours. Otherwise, to extend the holding time to 14 days and mitigate interferences, treat the sample immediately using any or all of the following techniques, as necessary, followed by adjustment of the sample pH to > 12 and refrigeration as specified. There may be interferences that are not mitigated by approved procedures. Any procedure for removal or suppression of an interference may be employed, provided the laboratory demonstrates that it more accurately measures cyanide. Particulate cyanide (e.g., ferric ferrocyanide) or a strong cyanide complex (e.g., cobalt cyanide) are more accurately measured if the laboratory holds the sample at room temperature and pH > 12 for a minimum of 4 hours prior to analysis, and performs UV digestion or dissolution under alkaline (pH=12) conditions, if necessary.

(1) SULFUR: To remove elemental sulfur (S₈), filter the sample immediately. If the filtration time will exceed 15 minutes, use a larger filter or a method that requires a smaller sample volume (e.g., EPA Method 335.4 or Lachat Method 01). Adjust the pH of the filtrate to > 12 with NaOH, refrigerate the filter and filtrate, and ship or transport to the laboratory. In the laboratory, extract the filter with 100 mL of 5% NaOH solution for a minimum of 2 hours. Filter the extract and discard the solids. Combine the 5% NaOH-extracted filtrate with the initial filtrate, lower the pH to approximately 12 with concentrated hydrochloric or sulfuric acid, and analyze the combined filtrate. Because the detection limit for cyanide will be increased by dilution by the filtrate from the solids, test the sample with and without the solids procedure if a low detection limit for cyanide is necessary. Do not use the solids procedure if a higher cyanide concentration is obtained without it. Alternatively, analyze the filtrates from the sample and the solids separately, add the amounts determined (in µg or mg), and divide by the original sample volume to obtain the cyanide concentration.

(2) SULFIDE: If the sample contains sulfide as determined by lead acetate paper, or if sulfide is known or suspected to be present, immediately conduct one of the volatilization treatments or the precipitation treatment as follows: Volatilization—Headspace expelling. In a fume hood or well-ventilated area, transfer 0.75 liter of sample to a 4.4 L collapsible container (e.g., Cubitainer™). Acidify with concentrated hydrochloric acid to pH

< 2. Cap the container and shake vigorously for 30 seconds. Remove the cap and expel the headspace into the fume hood or open area by collapsing the container without expelling the sample. Refill the headspace by expanding the container. Repeat expelling a total of five headspace volumes. Adjust the pH to > 12, refrigerate, and ship or transport to the laboratory. Scaling to a smaller or larger sample volume must maintain the air to sample volume ratio. A larger volume of air will result in too great a loss of cyanide (> 10%). Dynamic stripping: In a fume hood or well-ventilated area, transfer 0.75 liter of sample to a container of the material specified and acidify with concentrated hydrochloric acid to pH < 2. Using a calibrated air sampling pump or flowmeter, purge the acidified sample into the fume hood or open area through a fritted glass aerator at a flow rate of 2.25 L/min for 4 minutes. Adjust the pH to >

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times

Applicable to all Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

12, refrigerate, and ship or transport to the laboratory. Scaling to a smaller or larger sample volume must maintain the air to sample volume ratio. A larger volume of air will result in too great a loss of cyanide (> 10%). Precipitation: If the sample contains particulate matter that would be removed by filtration, filter the sample prior to treatment to assure that cyanide associated with the particulate matter is included in the measurement. Ship or transport the filter to the laboratory. In the laboratory, extract the filter with 100 mL of 5% NaOH solution for a minimum of 2 hours. Filter the extract and discard the solids. Combine the 5% NaOH-extracted filtrate with the initial filtrate, lower the pH to approximately 12 with concentrated hydrochloric or sulfuric acid, and analyze the combined filtrate. Because the detection limit for cyanide will be increased by dilution by the filtrate from the solids, test the sample with and without the solids procedure if a low detection limit for cyanide is necessary. Do not use the solids procedure if a higher cyanide concentration is obtained without it. Alternatively, analyze the filtrates from the sample and the solids separately, add the amounts determined (in µg or mg), and divide by the original sample volume to obtain the cyanide concentration. For removal of sulfide by precipitation, raise the pH of the sample to > 12 with NaOH solution, then add approximately 1 mg of powdered cadmium chloride for each mL of sample. For example, add approximately 500 mg to a 500-mL sample. Cap and shake the container to mix. Allow the precipitate to settle and test the sample with lead acetate paper. If necessary, add cadmium chloride but avoid adding an excess. Finally, filter through 0.45 micron filter. Cool the sample as specified and ship or transport the filtrate and filter to the laboratory. In the laboratory, extract the filter with 100 mL of 5% NaOH solution for a minimum of 2 hours. Filter the extract and discard the solids. Combine the 5% NaOH-extracted filtrate with the initial filtrate, lower the pH to approximately 12 with concentrated hydrochloric or sulfuric acid, and analyze the combined filtrate. Because the detection limit for cyanide will be increased by dilution by the filtrate from the solids, test the sample with and without the solids procedure if a low detection limit for cyanide is necessary. Do not use the solids procedure if a higher cyanide concentration is obtained without it. Alternatively, analyze the filtrates from the sample and the solids separately, add the amounts determined (in µg or mg), and divide by the original sample volume to obtain the cyanide concentration. If a ligand-exchange method is used (e.g., ASTM D6888), it may be necessary to increase the ligand-exchange reagent to offset any excess of cadmium chloride.

(3) SULFITE, THIOSULFATE, OR THIOCYANATE: If sulfite, thiosulfate, or thiocyanate is known or suspected to be present, use UV digestion with a glass coil (Method Kelada-01) or ligand exchange (Method OIA-1677) to preclude cyanide loss or positive interference.

(4) ALDEHYDE: If formaldehyde, acetaldehyde, or another water-soluble aldehyde is known or suspected to be present, treat the sample with 20 mL of 3.5% ethylenediamine solution per liter of sample.

(5) CARBONATE: Carbonate interference is evidenced by noticeable effervescence upon acidification in the distillation flask, a reduction in the pH of the absorber solution, and incomplete cyanide spike recovery. When significant carbonate is present, adjust the pH to ≥12 using calcium hydroxide instead of sodium hydroxide. Allow the precipitate to settle and decant or filter the sample prior to analysis (also see Standard Method 4500-CN.B.3.d).

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times
Applicable to all Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

(6) CHLORINE, HYPOCHLORITE, OR OTHER OXIDANT: Treat a sample known or suspected to contain chlorine, hypochlorite, or other oxidant as directed in footnote 5.

¹¹ For dissolved metals, filter grab samples within 15 minutes of collection and before adding preservatives. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), filter the sample within 15 minutes after completion of collection and before adding preservatives. If it is known or suspected that dissolved sample integrity will be compromised during collection of a composite sample collected automatically over time (e.g., by interchange of a metal between dissolved and suspended forms), collect and filter grab samples to be composited (footnote 2) in place of a composite sample collected automatically.

¹² To achieve the 28-day holding time, use the ammonium sulfate buffer solution specified in EPA Method 218.6. The allowance in this footnote supersedes preservation and holding time requirements in the approved hexavalent chromium methods, unless this supersession would compromise the measurement, in which case requirements in the method must be followed.

¹³ Samples collected for the determination of trace level mercury (<100 ng/L) using EPA Method 1631 must be collected in tightly-capped fluoropolymer or glass bottles and preserved with BrCl or HCl solution within 48 hours of sample collection. The time to preservation may be extended to 28 days if a sample is oxidized in the sample bottle. A sample collected for dissolved trace level mercury should be filtered in the laboratory within 24 hours of the time of collection. However, if circumstances preclude overnight shipment, the sample should be filtered in a designated clean area in the field in accordance with procedures given in Method 1669. If sample integrity will not be maintained by shipment to and filtration in the laboratory, the sample must be filtered in a designated clean area in the field within the time period necessary to maintain sample integrity. A sample that has been collected for determination of total or dissolved trace level mercury must be analyzed within 90 days of sample collection.

¹⁴ An aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls. If the sample must be analyzed within 24 hours of collection, add the acid immediately (see footnote 2). Soil and sediment samples do not need to be preserved with acid. The allowances in this footnote supersede the preservation and holding time requirements in the approved metals methods.

¹⁵ Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

¹⁶ If the sample is not adjusted to pH 2, then the sample must be analyzed within seven days of sampling.

¹⁷ The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times

Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

¹⁸ When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity (i.e., use all necessary preservatives and hold for the shortest time listed). When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to ≤ 6 °C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6–9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (regarding the requirement for thiosulfate reduction), and footnotes 19, 20 (regarding the analysis of benzidine).

¹⁹ If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

²⁰ Extracts may be stored up to 30 days at < 0 °C.

²¹ For the analysis of diphenylnitrosamine, add 0.008% $\text{Na}_2\text{S}_2\text{O}_3$ and adjust pH to 7–10 with NaOH within 24 hours of sampling

²² The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $\text{Na}_2\text{S}_2\text{O}_3$.

²³ Holding time is calculated from time of sample collection to elution for samples shipped to the laboratory in bulk and calculated from the time of sample filtration to elution for samples filtered in the field

Table FS 1000-5
Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times
For Analytes not Found in 40 CFR 136

Analyte	Methods	Reference ¹	Container ²	Preservation ³	Maximum Holding Time ⁴
Bromine	DPD Colorimetric ⁵	SM 4500-Cl-G	P, G	None required	Analyze immediately
Bromates	Ion Chromatography	EPA 300.0 ⁶	P, G	Cool 4°C	30 days
Chlorophylls	Spectrophotometric	SM 10200 H	P, G ⁷	Dark 4°C Filtered, dark, -20°C	48 hours chilled until filtration ⁸ , and analyze immediately or 48 hours chilled until filtration ⁸ , and 28 days (frozen) after filtration
Corrosivity	Calculated (CaCO ₃ Stability, Langelier Index)	SM 2330 ASTM D513-92	P, G	Cool 4°C ⁹	7 days ⁹
FL-PRO	Gas Chromatography	DEP (11/1/95)	G only	Cool 4°C, H ₂ SO ₄ or HCl to pH<2	7 days until extraction, 40 days after extraction
Odor	Human Panel	SM 2150	G only	Cool 4°C	6 hours
Salinity	Electrometric ¹⁰ Hydrometric ¹⁰	SM 2520 B SM 2520 C	G, wax seal	Analyze immediately or use wax seal	30 days ¹⁰
Taste	Human Panel	SM 2160 B, C, D ASTM E679-91	G only	Cool 4°C	24 hours
Total Dissolved Gases	Direct-sensing Membrane-diffusion	SM 2810	_____	_____	Analyze in-situ
Total Petroleum Hydrocarbons	Gravimetry	EPA 1664	G only	Cool 4°C, H ₂ SO ₄ or HCl to pH<2	28 days
Transparency	Irradiometric ¹¹	62-302.200(6), FAC	_____	_____	Analyze in-situ
Un-ionized Ammonia	Calculated ¹²	DEP-SOP ¹³	P, G	Cool 4°C Na ₂ S ₂ O ₃ ¹²	8 hours unpreserved 28 days preserved ¹²
Organic Pesticides ¹⁴	GC and HPLC	EPA (600-series) ¹⁴	¹⁵	¹⁵	¹⁵

¹ SM XXXX = procedures from "Standard Methods for the Examination of Water and Wastewater", APHA-AWWA-WPCF, 20th edition, 1998 and Standard Methods Online.

ASTM XXXX-YY = procedure from "Annual Book of ASTM Standards", Volumes 11.01 and 11.02 (Water I and II), 1999.

² P = plastic, G = glass.

³ When specified, sample preservation should be performed immediately upon sample collection.

⁴ The times listed are the maximum times that samples may be held before analysis and still be considered valid.

Table FS 1000-5
Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times
For Analytes not Found in 40 CFR 136

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- ⁵ The approved procedure is for residual chlorine. However, in the absence of chlorine, the DPD colorimetric procedure can be adapted to measure bromine content of the sample. In such case, the validity of this assumption must be verified by using another procedure for chlorine which is not affected by the presence of bromine (i.e., negligible interference).
- ⁶ The Determination of Inorganic Anions in Water by Ion Chromatography", EPA Method 300.0, Revised August 1993, by John D. Pfaff, U. S. EPA Cincinnati, Ohio 45268.
- ⁷ Collect samples in opaque bottles and process under reduced light.
- ⁸ Samples must be filtered within 48 hours of collection. Add magnesium carbonate to the filter while the last of the sample passes through the filter..
- ⁹ Temperature and pH must be measured on site at the time of sample collection. 7 days is the maximum time for laboratory analysis of total alkalinity, calcium ion and total solids.
- ¹⁰ The electrometric and hydrometric analytical methods are suited for field use. The argentometric method is suited for laboratory use. Samples collected for laboratory analysis, when properly sealed with paraffin waxed stopper, may be held indefinitely. The maximum holding time of 30 days is recommended as a practical regulatory limit.
- ¹¹ Transparency in surface waters is defined as a compensation point for photosynthetic activity, i.e., the depth at which one percent of the light intensity entering at the water surface remains unabsorbed. The DEP Chapter 62-302, FAC requires that the light intensities at the surface and subsurface be measured simultaneously by irradiance meters such as the Kahlsico Underwater Irradiometer, Model No. 268 WA 310, or an equivalent device having a comparable spectral response.
- ¹² The results of the measurements of pH, temperature, salinity (if applicable) and the ammonium ion concentration in the sample are used to calculate the concentration of ammonia in the unionized state. Temperature, pH and salinity must be measured on-site at the time of sample collection. Laboratory analysis of the ammonium ion concentration should be conducted within eight hours of sample collection. If prompt analysis of ammonia is impossible, preserve samples with H₂SO₄ to pH between 1.5 and 2. Acid-preserved samples, stored at 4°C, may be held up to 28 days for ammonia determination. Sodium thiosulfate should only be used if fresh samples contain residual chlorine.
- ¹³ DEP Central Analytical Laboratory, Tallahassee, FL, Revision No. 2, 2-12-2001. The document is available from the DEP Standards & Assessment Section..
- ¹⁴ Other pesticides listed in approved EPA methods (608.1, 608.2, 614, 614.1, 615, 617, 618, 619, 622, 622.1, 627, 629, 631, 632, 632.1, 633, 642, 643, 644 and 645) that are not included in Table ID of 40 CFR Part 136 (July 2007).
- ¹⁵ Container, preservation and holding time as specified in each individual method must be followed.

Table FS 1000-6
Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples

Analyte	Methods	References	Container	Preservation	Maximum Holding Times
Volatile Organics	Purge-and-Trap GC and GC-MS	8015, 8260, 8021, 5035	See Table 1000-7		
Semivolatile Organics	GC, HPLC, and GC-MS	8041, 8061, 8070, 8081, 8082, 8091, 8111, 8121, 8131, 8141, 8151, 8270, 8275, 8280, 8290, 8310, 8315, 8316, 8318, 8321, 8325, 8330, 8331, 8332, 8410, 8430, 8440, FL-PRO	Glass, 8 oz widemouth with Teflon® -Lined lid	Cool 4°C ¹	14 days until extraction, 40 days after extraction
Dioxins		8290	Amber Glass, 8 oz widemouth with Teflon® -Lined lid	Cool 4°C ¹ in dark	30 days until extraction, 45 days after extraction
Total Metals-except mercury and chromium VI methods	Flame AA, Furnace AA, Hydride and ICP	All 7000-series (except 7195, 7196, 7197, 7198, 7470 and 7471), and 6010 (ICP)	Glass or plastic 8 oz widemouth (200 grams sample)	None	6 months
Chromium VI	Colorimetric, Chelation with Flame AA (200 gram sample)	7196 and 7197 (prep 3060)	Glass or plastic, 8 oz widemouth (200 gram sample)	Cool 4° ± 2°C ¹	1 month until extraction, 4 days after extraction ²
Mercury	Manual Cold Vapor AA	7471	Glass or plastic 8 oz widemouth (200 grams sample)	Cool 4° ± 2°C ¹	28 days
Microbiology (MPN)		MPN	Sterile glass or plastic	Cool 4°C ¹	24 hours
Aggregate Properties			Glass or plastic	Cool 4°C ¹	14 days
Inorganic nonmetallics all except:			Glass or plastic	Cool 4°C ¹	28 days
----- Sulfite, Nitrate, Nitrite & o-phosphate			Glass or plastic		48 hours
----- Elemental Phosphorus			Glass		48 hours

Table FS 1000-6

Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples

The term "residuals" include: (1) sludges of domestic origin having no specific requirements in Tables FS-1000-4 or FS-1000-9; (2) sludges of industrial origin; and (3) concentrated waste samples.

¹ Keep soils, sediments and sludges cool at 4°C from collection time until analysis. No preservation is required for concentrated waste samples.

² Storage Temperature is 4°C, $\pm 2^\circ\text{C}$

Table FS 1000-7

Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035

Conc. Level	Sampling Device	Collection Procedure	Sample Container		Preservation	Sample Preparation	Max HT ^①	Determinative Procedure
			Type	Vial Preparation				
≤200 ug/kg	Coring Device	5035 - Section 6.2.1	Glass Vial w/ PTFE-silicone Septum	5035 - 6.1.1	NaHSO ₄ / 4°C	5035 - Section 7.2	14 D	Any recognized VOC Method
				5035 - 6.1.1 ^②	4°C	5035 - Section 7.2	48 H	Any recognized VOC Method
				5035 - 6.1.1 ^②	4°C / -10°C ^{③,④}	5035 - Section 7.2	48 H / 14 D ^⑤	Any recognized VOC Method
	EnCore or equivalent	5035 - Section 6.2.1	EnCore or equivalent	5035 - 6.1.1 ^{②,⑥,⑦}	4°C	5035 - Section 7.2	48 H	Any recognized VOC Method
		5035 - Section 6.2.1	EnCore or equivalent	5035 - 6.1.1 ^{⑥,⑦}	NaHSO ₄ / 4°C	5035 - Section 7.2 ^⑤	48 H / 14 D ^⑤	Any recognized VOC Method
		5035 - Section 6.2.1	EnCore or equivalent	5035-6.1.1 ^{②⑥⑦}	4°C / -10°C ^{③,④}	5035 - Section 7.2 ^⑤	48 H / 14 D ^⑤	Any recognized VOC Method
>200 ug/kg	EnCore or equivalent	5035 - Section 6.2.2.3 ^⑥	EnCore or equivalent	5035 - 6.1.3 ^{⑥,⑦}	4°C	5035 - Sections 7.3.2 & 7.3.3 ^⑥	48 H / 14 D ^⑤	Any recognized VOC Method
>200 ug/kg ^⑧	Coring Device	5035 - Section 6.2.2.3 ^⑧	Glass Vial w/ PTFE-silicone Septum	6.1.3 ^⑧	Methanol/PEG + 4°C	5035 - Section 7.3.4	14 D	Any recognized VOC Method
	Conventional Devices	DEP SOP - Section 4.3	Glass w/ PTFE-silicone Septum	6.1.2	4°C	5035 - Sections 7.3.1 - 7.3.3	14 D	Any recognized VOC Method
Oily Waste	Conventional Devices	5035 - Section 6.2.4.2	Glass w/ PTFE-silicone Septum	6.1.4	4°C	5035 - Sections 7.4.1 - 7.4.2	14 D	Any recognized VOC Method
	Conventional Devices	5035 - Section 6.2.4.1	Glass w/ PTFE-silicone Septum	6.1.4	Methanol/PEG + 4°C	5035 - Sections 7.4.3	14 D	Any recognized VOC Method
Dry Wt.	Conventional Devices		Glass with Teflon liner		4°C	5035 - Section 7.5		
Soil Screen	Conventional Devices	DEP SOP - Section 4.3	Glass w/ PTFE-silicone Septum		4°C	5035 - Section 7.1	14 D	Any recognized VOC Method

Table FS 1000-7

Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035

- ① Maximum time allowable from time/date of collection to sample analysis.
- ② Eliminate 6.1.1.2; use only organic-free water.
- ③ Contents of sampling device must be transported to the laboratory at 4°C and stored at -10°C.
- ④ In order to ensure that vials do not break during freezing, they should be stored on their side or at a slanted angle to maximize surface area.
- ⑤ Maximum allowable time at 4°C is 48 hours; maximum allowable time to sample analysis is 14 days (from time of sample collection).
- ⑥ Conducted in the laboratory.
- ⑦ Entire contents of sampling device are extruded into the sample analysis vial containing the appropriate solvent.
- ⑧ Procedures are limited only to those situations or programs in which the maximum contamination level does not exceed 200 ug/kg.
- ⑨ Methanolic preservation in the field is not recommended, but may be used if approved by an DEP program.

FS 1000-8
Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte	Preservation ¹	Holding Time ²	Holding Time for Extract ³	Container ⁴
MICROBIOLOGICAL-BACTERIA	Cool < 10°C, Na ₂ S ₂ O ₃ ⁵			P or G
Total Coliforms, fecal coliforms & <i>E. coli</i> in drinking water	Cool < 10°C ⁶ , Na ₂ S ₂ O ₃ ⁵	30 Hours ⁷		P or G
Total coliforms and fecal coliforms in source water Heterotrophic bacteria in drinking water	Cool < 10°C, Na ₂ S ₂ O ₃ ⁵	8 hours		P or G
Gross Alpha	Conc. HCl or HNO ₃ to pH <2 ^{8,9}	6 mo		P or G
Gross beta	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Strontium-89	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Strontium-90	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Radium-226	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Radium-228	Conc. HCl or HNO to pH <2 ^{8,9}	6 mo		P or G
Cesium-134	Concentrated HCl to pH <<2 ^{8,9}	6 mo		P or G
Iodine-131	None	8 da		P or G
Tritium	None	6 months		G
Uranium	Conc. HCl or HNO ₃ to pH <2 ^{8,9}	6 mo		P or G
Photon emitters	Conc. HCl or HNO ₃ to pH <2 ^{8,9}	6 mo		P or G
Asbestos	Cool 4°C	48 hours		P or G
Bromate	Ethylenediamine (50mg/L)	28 days		P or G
Cyanide	Cool, 4°C, Ascorbic acid (if chlorinated), NaOH pH>12	14 days		P or G
Nitrate	Cool, 4°C	48 hours		P or G
Nitrate (chlorinated source)	Cool, 4°C	14 days		P or G
Odor	Cool 4°C	24 hours		G
502.2	Sodium Thiosulfate or Ascorbic Acid, 4°C HCl pH<2 if Ascorbic Acid is used	14 days		Glass with PTFE Lined Septum

FS 1000-8

Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte	Preservation ¹	Holding Time ²	Holding Time for Extract ³	Container ⁴
504.1	Sodium Thiosulfate Cool, 4°C,	14 days	4°C, 24 hours	Glass with PFTE-Lined Septum
505	Sodium Thiosulfate Cool, 4°C	14 days (7 days for Heptachlor)	4°C, 24 hours	Glass with PFTE-Lined Septum
506	Sodium Thiosulfate Cool, 4°C, Dark	14 days	4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
507	Sodium Thiosulfate Cool, 4°C, Dark	14 days (see method for exceptions)	4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
508	Sodium Thiosulfate Cool, 4°C, Dark	7 days (see method for exceptions)	4°C, dark, 14 days	Glass with PFTE-lined Cap
508A	Cool, 4°C	14 days	30 days	Glass with PFTE-lined Cap
508.1	Sodium Sulfite, HCl pH<2, Cool, 4°C	14 days (see method for exceptions)	30 days	Glass with PFTE-lined Cap
515.1	Sodium Thiosulfate Cool, 4°C, Dark	14 days	4°C, dark, 28 days	Amber Glass with PFTE-lined Cap
515.2	Sodium Thiosulfate HCl pH<2, Cool, 4°C, Dark	14 days	≤ 4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
515.3	Sodium Thiosulfate HCl pH<2, Cool, 4°C, Dark	14 days	≤ 4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
515.4	Sodium Sulfite, HCl pH<2, Cool, ≤10°C for first 48 hours ≤6°C thereafter, Dark	14 days	≤0°C, 21 days	
524.2	Ascorbic Acid, HCl pH<2, Cool 4°C	14 days		Glass with PFTE-lined Septum
525.2	Sodium Sulfite, Dark, Cool, 4°C, HCl pH<2	14 days (see method for exceptions)	≤ 4°C, 30 days from collection	Amber Glass with PFTE-lined Cap
531.1, 6610	Sodium Thiosulfate Monochloroacetic acid, pH<3, Cool, 4°C	Cool 4°C, 28 days		Glass with PFTE-lined Septum
531.2	Sodium Thiosulfate, Potassium Dihydrogen Citrate buffer to pH 4,	28 days		

FS 1000-8

Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte	Preservation ¹	Holding Time ²	Holding Time for Extract ³	Container ⁴
	dark, ≤10°C for first 48 hr, ≤6°C thereafter			
547	Sodium Thiosulfate Cool, 4°C	14 days (18 mo. frozen)		Glass with PTFE-lined Septum
548.1	Sodium Thiosulfate (HCl pH 1.5-2 if high biological activity), Cool, 4°C, Dark	7 days	≤4°C 14 days	Amber Glass with PTFE-lined Septum
549.2	Sodium Thiosulfate (H ₂ SO ₄ pH<2 if biologically active), Cool, 4°C, Dark	7 days	21 days	High Density Amber Plastic or Silanized Amber Glass
550, 550.1	Sodium Thiosulfate Cool, 4°C, HCl pH<2	7 days	550, 30 days 550.1, 40 days Dark, 4°C	Amber Glass with PTFE-lined Cap
551.1	Sodium Thiosulfate, Sodium Sulfite, Ammonium Chloride, pH 4.5-5.0 with phosphate buffer, Cool, 4°C	14 days		Glass with PTFE-lined Septum
552.1	Ammonium chloride, Cool, 4°C, Dark	14 days	≤4°C, dark 48 hours	Amber Glass with PTFE-lined cap
552.2	Ammonium chloride, Cool, 4°C, Dark	14 days	≤4°C, dark 7 days ≤-10°C 14 days	Amber Glass with PTFE-lined cap
555	Sodium Sulfite, HCl, pH ≤ 2, Dark, Cool 4°C	14 days		Glass with PTFE-lined cap
1613B	Sodium Thiosulfate, Cool, 0-4°C, Dark		Recommend 40 days	Amber Glass with PTFE-lined Cap

¹ Preservation, when required, must be done immediately upon sample collection.

² Stated values are the maximum regulatory holding times. Sample processing must begin by the stated time.

³ Stated time is the maximum time a prepared sample extract may be held before analysis.

⁴ (P) polyethylene or (G) or glass. For microbiology, plastic sample containers must be made of sterilizable materials (poly-propylene or other autoclavable plastic).

⁵ Addition of sodium thiosulfate is only required if the sample has a detectable amount of residual chlorine, as indicated by a field test using EPA Method 330.4 or 330.2 or equivalent.

FS 1000-8

Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

- ⁶ Temperature requirement applies only to source water samples, however once received by the laboratory, if sample processing does not begin on the same working day, samples must be refrigerated.
- ⁷ If samples are analyzed after 30 hours, but within 48 hours of collection, the laboratory is to indicate in the analytical report that the data may be invalid because of excessive delay in sample processing. No samples received after 48 hours are to be accepted or analyzed for compliance with the regulations of the Department of Environmental Protection or the Department of Health.
- ⁸ It is recommended that the preservative be added at the time of collection unless suspended solids activity is to be measured. It is also recommended that samples be filtered, if suspended or settleable solids are present, prior to adding preservative, at the time of collection. However, if the sample has to be shipped to a laboratory or storage area, acidification of the sample (in its original container) may be delayed for a period not to exceed 5 days. A minimum of 16 hours must elapse between acidification and analysis.
- ⁹ If HCl is used to acidify samples, which are to be analyzed for gross alpha or gross beta activities, the acid salts must be converted to nitrate salts before transfer of the samples to planchets.

Table FS 1000-9
Containers, Preservation and Holding Times for Biosolids Samples and Protozoans

<i>ANALYTE NAME</i>	<i>CONTAINER</i>	<i>PRESERVATION</i>	<i>MAX HOLDING TIME</i>
Fecal Coliform	Plastic or Glass	Cool 4°C	24 hours
Salmonella	Plastic or Glass	< 10°C	24 hours
Enteric Viruses	Plastic or Glass	Up to 25°C	2 hours
Enteric Viruses	Plastic or Glass	2 to 10°C	48 hours
Specific Oxygen Uptake Rate	Plastic or Glass	None	As Soon As Possible
Helminth OVA	Plastic or Glass	< 4°C (Do not Freeze)	24 hours
Cryptosporidium/Giardia	Plastic or Glass	0 - 8°C (Do not Freeze)*	96 Hours
Total Solids	Plastic or Glass	≤6°C (Do not Freeze)	7 days
Metallics	Plastic or Glass	See Tables FS 1000-4, FS 1000-5 and FS 1000-6	
Other Inorganic Pollutants	Plastic or Glass	See Tables FS 1000-4, FS 1000-5 and FS 1000-6	

***Dechlorinate bulk samples when applicable**

Table FS 1000-10
Container Materials, Preservation, and Holding Times for Fish and Shellfish

Analyte	Matrix	Sample Container	Field (Transport to Lab)		Laboratory	
			Preservation	Maximum Shipping Time	Storage	Holding Time
	Whole Organism (Fish, shellfish, etc.	Foil-wrap each organism (or composite for shellfish) and transport in waterproof plastic bag	Cool in wet ice or: ----- Freeze on dry ice	24 hours		
Mercury	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE			Freeze at <-20°C	28 days
Other metals	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE		48 hours	Freeze at <-20°C	6 months
Organics	Tissue (fillets and edible portions, homogenates)	Borosilicate glass, PTFE, quartz, aluminum foil			Freeze at <-20°C	1 year
Dioxin	Tissue (fillets and edible portions, homogenates)	Amber containers: Borosilicate glass, PTFE, quartz, aluminum foil			Freeze at <-20°C	30 days until extraction, 15 days after extraction
Lipids	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE			Freeze at <-20°C	1 year

PTFE = Polytetrafluoroethylene (Teflon)

Table FS 1000-11
Holding Times for SPLP or TCLP Extraction, Sample Preparation and Determinative Analysis

Holding Time (Days)				
	From: Field Collection	From: SPLP or TCLP Extraction	From: Preparative Extraction	Total Elapsed Time
	To: SPLP or TCLP Extraction	To: Preparative Extraction	To: Determinative Analysis	
Volatiles	14	NA	14	28
Semi-Volatiles	14	7	40	61
Mercury	28	NA	28	56
Metals, except Mercury	180	NA	180	360

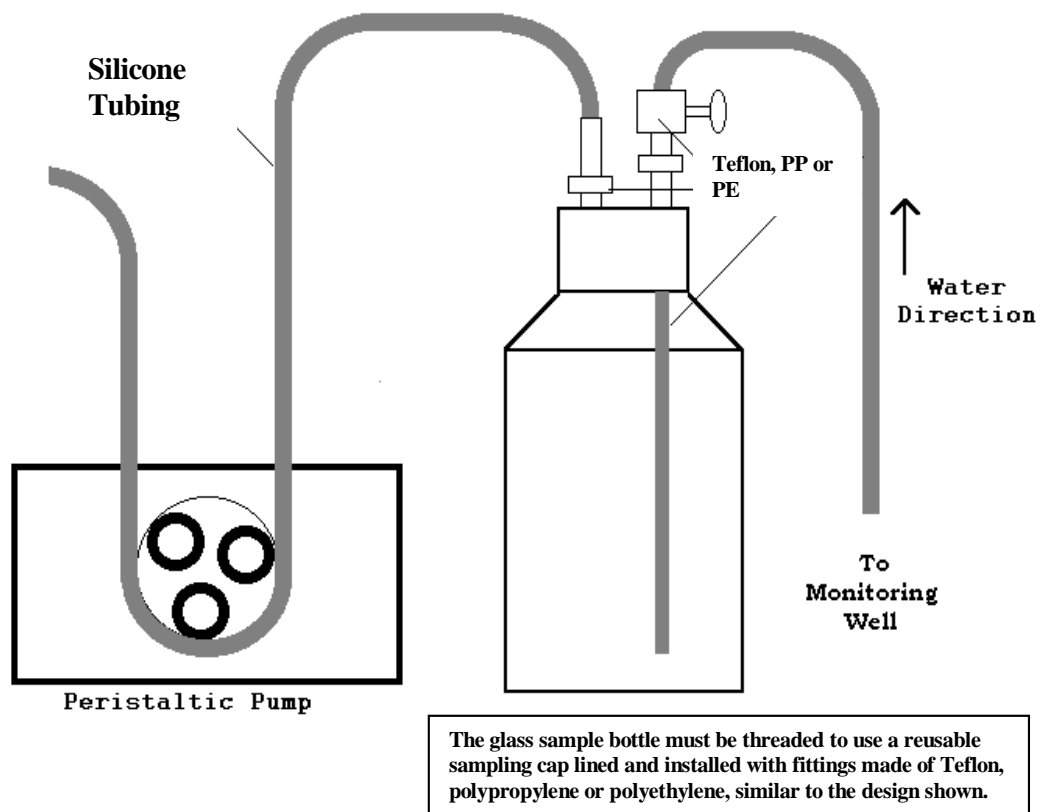
NA – Not Applicable

Table FS 1000-12
Preventive Maintenance Tasks

INSTRUMENT/ACTIVITY	FREQUENCY
REFRIGERATORS, INCUBATORS, OVENS	
Clean interior	Monthly
Check thermometer temperature against certified thermometer or equivalent	Annually
ANYTICAL BALANCES	
Clean pan and compartment	Daily ¹
Check with Class S weights	Monthly
Manufacturer cleaning and calibration	Annually
pH AND ION SELECTIVE ELECTRODES	
PROBE	
Check probe for cracks and proper levels of filling solution; check reference junction; clean electrode	Daily, Replace as necessary
Check response time	Daily ¹
METER	
Check batteries and electronics for loose connections and cracked leads	Daily ¹ , Replace as necessary
TURBIDIMETER	
Clean instrument housing	Monthly
Clean cells	Daily ¹
CONDUCTIVITY METER	
Check batteries and probe cables	Daily ¹
Replatinize Probe	Per manufacturer's recommendations
DISSOLVED OXYGEN METERS	
PROBE	
Check membrane for deterioration; check filling solution	Daily ¹ , Replace as necessary
METER	
Battery level and electronics checked	Daily ¹ , Replace as necessary
THERMOMETERS	
Check for cracks and gaps in the mercury	Daily ¹ , Replace as necessary
TEMPERATURE PROBE	
Check connections, cables	Daily ¹
Check against calibrated thermometer	Daily ¹
AUTOMATIC SAMPLE COLLECTION SYSTEMS (e.g., ISCO, Sigma)	
Check sampler operation (forward, reverse, automatic through three cycles of the purge-pump-purge cycle)	Daily ¹ Prior to Sampling Event
Check purge-pump-purge cycle when sampler is installed	Daily ¹ Prior to Sampling Event
Check the flow pacer that activates the sampler to assure proper operation	Daily ¹ Prior to Sampling Event
Check desiccant	Daily ¹ , Replace as Necessary
Check batteries	Daily ¹ , Replace as Necessary
Check pumping rate against manufacturer's specifications	Daily ¹ , Replace as Necessary

¹Daily is defined as prior to use or a 12-hour period if equipment is run continuously

Figure FS 1000-1
Organic Trap Configuration for Collecting Extractable Organics with a Peristaltic Pump



FS 2000. GENERAL AQUEOUS SAMPLING

See also the following Standard Operating Procedures:

- FA 1000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000-9000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements

1. COMMON PROCEDURES

The following procedures are applicable to the collection of all water samples.

1.1. Refer to FS 1000 for procedures that are common to all types of sample collection including general preservation and thermal preservation procedures.

1.2. Grab Samples

1.2.1.1. This is an individual sample collected over a period of time, usually all in one motion, generally not exceeding 15 minutes. The 15-minute time limit applies to aqueous samples only. No time limit applies to the collection of solid samples (e.g., residuals).

1.2.1.2. Grab samples represent the conditions that exist at the moment the sample is collected and do not necessarily represent conditions at any other time. Grab sampling is the preferred method of sampling under the following conditions:

- A snapshot of the water quality at a particular instant in time is desired.
- The water or wastewater stream is not continuous (e.g., batch discharges or intermittent flow).
- The characteristics of the water or waste stream are known to be constant or nearly so.
- When conditions are relatively constant over the period of discharge. In lieu of complex sampling activities, a grab sample provides a simple and accurate method of establishing waste characteristics.
- The sample is to be analyzed for analytes whose characteristics are likely to change significantly with time (e.g., dissolved gases, microbiological tests, pH).
- The sample is to be collected for analytes such as Oil and Grease, bacteriological tests or other parameters listed in number 3 of this section where the compositing process could significantly affect the actual concentration.
- Data on maximum/minimum concentrations are desired for a continuous water or wastewater stream.
- When identifying and tracking slug loads and spills.

1.2.1.3. If required, measure the following parameters on grab samples or in-situ.

NOTE: If the permit specifies a composite sample for any of the parameters mentioned below, **FOLLOW THE PERMIT CONDITIONS**

Cyanide	Oil and Grease
Residual Chlorine	pH
Dissolved constituents in field-filtered samples (ortho-phosphorus, metals, etc.)	Specific Conductance
Dissolved Oxygen and other dissolved gases	Un-ionized Ammonia
Microbiological Parameters	Volatile Organic Compounds
TRPHs	Temperature
Total Phenols	

1.3. Composite Samples

1.3.1. A composite sample is a sample collected over time, formed either by continuous sampling or by mixing discrete samples. Composite samples reflect the average characteristics during the compositing period.

1.3.2. Composite samples are used when stipulated in a permit or when:

- The water or wastewater stream is continuous;
- Analytical capabilities are limited;
- Determining average pollutant concentration during the compositing period;
- Calculating mass/unit time loadings; or
- Associating average flow data to parameter concentrations

1.3.3. Composite samples may be collected individually at equal time intervals if the flow rate of the sample stream does not vary more than plus or minus ten percent of the average flow rate or they may be collected proportional to the flow rate. The permit or work plan will specify which composite sample type to use, either time composites or flow proportional composites. The compositing methods, all of which depend on either continuous or periodic sampling, are described in the following discussions.

1.3.3.1. Time Composite Sample: Time composite samples are based on a constant time interval between samples. A time composite sample can be collected manually or with an automatic sampler. This type of composite is composed of discrete sample aliquots collected in one container at constant time intervals. This method provides representative samples when the flow of the sampled wastewater stream is constant. This type of sample is similar to a sequential composite sample described in number 3.3 of this section.

1.3.3.2. Flow Proportional Composite Sample: Flow proportional samples can be collected automatically with an automatic sampler and a compatible pacing flow measuring device, semi-automatically with a flow chart and an automatic sampler capable of collecting discrete samples, or manually. There are two methods used to collect this type of sample:

- Method 1: Collect a constant sample volume per stream flow (e.g., a 200 mL sample collected for every 5,000 gallons of stream flow) at time intervals proportional to stream flow. This method provides representative samples of all waste streams when the flow is measured accurately.
- Method 2: Collect a sample by increasing the volume of each aliquot as the flow increases, while maintaining a constant time interval between the aliquots (e.g., hourly samples are taken with the sample volume being proportional to the flow at the time the sample is taken).

1.3.3.3. Sequential Composite Sample: Sequential composite samples are composed of discrete samples taken into individual containers at constant time intervals or constant discharge increments. For example, samples collected every 15 minutes are composited for each hour.

- The 24-hour composite is made up from the individual one-hour composites. Each of the 24 individual samples is manually flow-proportioned according to the flow recorded for the hour that the sample represents. Each flow-proportioned sample is then added to the composite samples. The actual compositing of the samples is done by hand and may be done in the field or the laboratory. In most cases, compositing in the field is preferable since only one sample container must be cooled, and then transported to, and handled, in the laboratory. A 24-hour composite is frequently used since an automatic sampler can easily collect the individual samples.
- A variation of the 24-hour composite is to collect a constant volume of sample taken at constant discharge increments, which are measured with a totalizer. For example, one aliquot is collected for every 10,000 gallons of flow
- Sequential sampling is useful to characterize the waste stream because you can determine the variability of the wastewater constituents over a daily period. For example, for pretreatment studies you can visually determine when high strength wastes are being discharged from a facility or when heavy solid loads are being discharged during a 24-hour cycle. You can measure the pH throughout the day. The value of this type of sampling must be weighed against the manpower constraints and sampling goals

1.3.3.4. Continuous Composite Sample: Collected continuously from the stream. The sample may be a constant volume that is similar to the time composite, or the volume may vary in proportion to the flow rate of the waste stream, in which case the sample is similar to the flow proportional composite.

1.3.3.5. Areal Composite: A sample composited from individual grab samples collected on an areal or cross-sectional basis. Areal composites must be made up of equal volumes of grab samples; each grab sample must be collected in an identical manner. Examples include residual samples from grid system points on a land application site, water samples collected at various depths at the same point or from quarter points in a stream, etc sample is similar to the flow proportional composite.

1.4. Collection Techniques

1.4.1. When filling a sample container that already contains premeasured preservative, slowly pour the sample down the side of the container so that the preservative does not

splatter. If the preservative is concentrated acid, and the sample water is added too quickly, the reaction between the water and the acid can generate enough heat to burn unprotected skin or could splatter and cause acid burning.

1.4.2. Collect grab samples (single, discrete samples) unless directed by permit, program, or approved sampling plan or work plan to collect composite samples.

1.4.3. Except for volatile organic compounds and sulfide, leave ample headspace in the sample bottle to allow for expansion, effervescence and proper mixing at the laboratory.

1.5. Collecting Filtered/Dissolved Samples

1.5.1. Certain studies or projects require collection of dissolved (i.e., filtered) samples. Identify all analytes in samples that are filtered as “dissolved” or “filtered” in field notes or laboratory transmittal forms and on final reports.

1.5.2. Collect both filtered and unfiltered samples from the same water in a collection device (e.g., bailer, intermediate container) or consecutively if sampling from a pump.

1.5.3. Collect dissolved metals in groundwater according to the procedures discussed in FS 2225. **Do not** collect filtered samples for metals from groundwater sources unless:

1.5.3.1. The DEP has required or approved the protocol and the DEP program allows the use of the procedure; or

1.5.3.2. The organization is documenting that a filtered groundwater sample is as or more representative of the groundwater quality. In this case, collect **both** unfiltered and filtered samples for analysis. Submit the results of both samples the DEP for review.

1.5.4. Filtration, when performed, must begin within 15 minutes of sample collection.

1.5.5. Collect dissolved groundwater samples for metals with a one-piece molded construction 1 µm filter unless otherwise specified by a DEP program. Use a 0.45 µm filter when filtering all other constituents **including** metals in surface water.

1.5.6. The filter must be compatible with the analyte to be filtered (e.g., zero carbon content for carbon analysis; non-protein binding filters for nitrogen).

1.5.7. Equipment blanks, when collected, must be processed through the filtration apparatus and analyzed for the analytes of interest.

1.5.8. Filters and filtration equipment are intermediate devices and therefore must be adequately rinsed per FS 2110 section 1.1.2.1.

THE FOLLOWING ARE SPECIAL CONSIDERATIONS FOR VARIOUS ANALYTE GROUPS:

FS 2001. *pH-Preserved Samples*

1. SAMPLE CONTAINERS

1.1. Use properly cleaned sample containers (see FC 1300).

1.2. Inspect all containers for visual defects or contamination. Discard if defects are present or containers do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Perform any filtration **before** the sample is poured into the container and **before** the sample is preserved.

2.2. Remove the cap from the sample container, and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

2.3. If the preservative is added after the sample is collected, (the container is not prepreserved), do not fill the container to the rim.

3. PRESERVATION

3.1. Preserve the sample within 15 minutes of sample collection or filtration (if applicable) unless collected as a composite sample (see FS 1006, section 1.3) or for analysis of lead and copper for drinking water compliance (see FS 2310, section 2).

3.2. Preserve the sample with the chemical specified by the method or preservation tables (Tables FS 1000-4 to FS 1000-10).

3.2.1. The chemical reagents must be pure enough so that the reagent does not contribute contamination or interferences to the analytes of interest.

3.3. Preserve the sample by adding an accurately measured amount of preservative to the container. Premeasured vials of the preservative, or a graduated container or pipet, may be used.

3.3.1. Tightly cap the sample container and gently tip the container two to three times to distribute the chemical.

3.4. The pH of the preserved sample must meet the pH criterion of the applicable preservation tables (see Tables FS 1000-4 to FS 1000-10). **Do not over preserve the sample.**

3.4.1. Pour an aliquot of the preserved sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH meets the required level. **Do not put the pH paper directly into the sample container.**

3.4.2. If the pH does not meet the required level, add additional measured amounts of preservative and test with narrow range pH paper (see section 3.4.1 above) until the pH meets the pH requirement.

3.4.3. Record the total amount of preservative that was added to the sample. This documentation is necessary for the next site visit, since additional acid may be needed to adequately preserve the sample on subsequent visits.

3.5. Cooling to less than 6°C with wet ice (see FS 1006, section 5) may be required.

3.6. Protect from direct sunlight.

3.7. Preserve at least one of the equipment blanks with the **greatest** amount of preservative that was required in the sample set and note the amount in field documentation.

3.8. After the sample has been preserved, screw the cap on tightly.

4. Verifying pH-Preserved Samples: Verify the pH of all pH-preserved samples (except volatile organics) in the field (see FS 2001, section 3.4). If samples are routinely collected from the same sample location, a pH check is not required each time samples are collected.

4.1. If the frequency of sample collection at a specified location is once per month or greater (e.g., weekly or daily), check the pH of **at least one** sample per parameter group according to the following schedule:

- 4.1.1. Weekly sampling: 1 pH check per month
- 4.1.2. Daily sampling: 1 pH check per week
- 4.2. If the frequency of sample collection at a specified location is once per month, check the pH of at least one sample per parameter group (except volatile organics) quarterly.
 - 4.2.1. If site conditions vary from sampling event to sampling event, perform pH checks at increased intervals.
 - 4.2.2. For all other sample collection frequencies, pH checks may be reduced as follows:
 - 4.2.2.1. During the first sampling event at a particular site, check **all** samples (except volatile organics) that are pH-adjusted, and
 - 4.2.2.2. During subsequent visits to a particular site, check **at least one** sample per parameter group that must be pH-adjusted.
5. DOCUMENTATION
 - 5.1. Complete the sample container label and stick firmly on the container.
 - 5.2. Complete the field notes.
 - 5.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment or preservation problems.

FS 2002. *Metals*

1. SAMPLE CONTAINERS
 - 1.1. Use properly cleaned containers (see FC 1300).
 - 1.2. Inspect the containers and caps for visual defects or contamination. Do not use containers if defects are present or if they do not appear clean.
2. SAMPLE COLLECTION PROCEDURES
 - 2.1. Perform any filtration **before** the sample is poured into the container and **before** the sample is preserved.
 - 2.2. Remove the cap from the sample container and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.
3. PRESERVATION - Follow preservation procedures outlined in FS 2001 above.
 - 3.1. Requirements for specific metals:
 - 3.1.1. For boron or cold-vapor atomic absorption Mercury with a grade of nitric acid (HNO₃) that is suitable for use for metals analysis. Use concentrated HNO₃ or 1:1 HNO₃ to lower the pH of less than 2 S.U., but greater than 1.62 S.U.
 - 3.1.2. For Chromium VI add sufficient ammonium sulfate buffer solution specified per Table FS 1000-4 to the sample to raise the pH of the sample to a pH of 9.3 – 9.7 and place in ice (see FS 2002).
 - 3.1.3. Trace Level Mercury
 - 3.1.3.1. Collect samples for trace level mercury (<100 ug/L) in tightly-capped fluoropolymer or glass bottles.

3.1.3.2. If the samples cannot be received by the laboratory within 48 hours of sample collection, preserve the sample with BrCl or HCl solution.

3.1.3.3. For dissolved trace level mercury, samples must be filtered through a 0.45 µm filter within 24 hours of sample collection. If the samples cannot be transported to the laboratory within 24 hours, follow the procedures in FS 8200 for field filtration.

3.1.4. Samples collected for lead and copper for drinking water compliance and metals other than those listed above do not require immediate acid preservation.

3.1.4.1. When samples are not acidified with acid, the transmittal form to the laboratory must:

- Clearly state that the samples are unpreserved; and
- Request that the laboratory preserve the samples.

3.1.4.2. If samples are acidified, use concentrated HNO₃ or 1:1 HNO₃ to lower the pH of less than 2 S.U., but greater than 1.62 S.U.

3.2. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

4.4. On the transmittal form, clearly identify samples that must be acidified by the laboratory (FS 2002, 3.1.3 or 3.1.4 above).

FS 2003. *Extractable Organics*

1. SAMPLE CONTAINERS

1.1. Most samples are collected in glass containers with Teflon-lined caps. Note: Teflon containers are also acceptable. There are some exceptions such as collecting samples in amber glass (e.g., nitroamines, nitroaromatics, etc.). If in doubt, verify the proper container type in Tables FS 1000-4 through FS 1000-10.

1.2. Inspect glass bottles to assure that there are no visual glass or liner defects. If defects are present and/or the sample containers do not appear clean, the bottles must be discarded.

1.3. Collect composite samples from automatic sample collection devices in refrigerated glass or Teflon containers through Teflon, polyethylene or polypropylene tubing.

2. SAMPLE COLLECTION PROCEDURES

2.1. Remove the cap from the sample container without touching the interior Teflon liner.

2.2. Carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

2.3. Fill bottle with sample to almost full capacity.

3. PRESERVATION

- 3.1. In general, these types of samples must be preserved by cooling to 4°C.
 - 3.1.1. Some analyte groups require a chemical preservation. See Tables FS 1000-4 through FS 1000-10 for any additional preservation.
 - 3.1.2. If the samples for pesticides cannot be extracted within 72 hours of collection, the sample pH must be in the range of 5 to 9. If needed, adjust sample to the specified pH range with sodium hydroxide or sulfuric acid.
 - 3.1.3. Add sodium thiosulfate if residual chlorine is present.
- 3.2. Place samples in **wet** ice within 15 minutes of sample collection (see FS 1006, section 5).
4. DOCUMENTATION
 - 4.1. Complete the sample container label and stick firmly on the container.
 - 4.2. Document when samples were placed in wet ice immediately (see FS 1006, section 5).
 - 4.3. Complete the field notes.
 - 4.4. Make notes on the lab transmittal form and the field records about any sample that appears highly contaminated or exhibits other abnormal characteristics (i.e., foaming, odor, etc.).

FS 2004. *Volatile Organics*

1. SAMPLE CONTAINERS
 - 1.1. Use a screw cap glass sample vial that is sealed with a Teflon-coated septum.
 - 1.2. Collect **at least two** vials of each sample. Some laboratories may require three or more vials, therefore verify the laboratory's policy on the number of vials they require unless the laboratory provides the sampling kit.
 - 1.3. Inspect the vials for glass or septum defects (e.g., rim must not have nicks or visible depressions and the septum must not be deformed). Do not use containers if defects are present or if they do not appear clean.
2. SAMPLE COLLECTION PROCEDURES
 - 2.1. Special precautions for petroleum sources:
 - 2.1.1. If possible, transport and store fuels in a separate vehicle from sampling equipment, empty vials and collected samples. If these items must be transported in the same vehicle as fuel, store the fuels as far away from the vials as possible.
 - 2.1.2. Place all fuel or exhaust sources downwind of the sampling location.
 - 2.1.3. Position all petroleum-fueled engines (including the vehicle) downwind of the sampling operations.
 - 2.2. Do not allow the sampling equipment or hands to touch the rim of the sample container.
 - 2.3. Do not remove septum caps from VOC vials until just prior to filling. Cap vials immediately after filling with sample.
 - 2.4. **DO NOT PRERINSE VOC VIALS.**

2.5. Do not aerate the sample during sample collection. If collecting from a spigot or pump, reduce the flow rate to less than 100 mL/min.

2.6. If preservation is required, proceed to section 3 below unless the laboratory supplied vials with premeasured quantities of acid, and the sample does not need to be dechlorinated (see 3.2 below).

2.6.1. If no preservation is required or if the vials are prepreserved (see 2.5 above), slowly and carefully allow the sample to flow down the **side** of the vial to minimize turbulence. Fill the vial until the surface tension holds the water in a "convex meniscus".

2.6.2. If a vial overflows during the filling process, document the problem and notify the laboratory that the vial may not contain sufficient acid.

2.6.3. If using a bailer, the bailer must be equipped with a controlled flow bottom assembly.

3. PRESERVATION

3.1. Preserve the sample **during** the sample collection process.

3.2. Dechlorination: Some treated water samples (drinking water and treated wastewater) may contain residual chlorine that must be removed with a dechlorination agent such as sodium thiosulfate or ascorbic acid. This process must occur **before** any additional preservatives (i.e., acid) are added. The dechlorination agent must be **in the vial** before the sample is added.

3.2.1. Laboratories may supply vials with premeasured quantities of dechlorination agent. If acid preservation **is not required**, fill the vials (see section 2.5.1 above) and proceed to section 4 below.

3.2.2. For chlorinated drinking water samples, add 3 mg sodium thiosulfate per 40 mL vial.

3.2.3. If the chlorine level is unknown, the concentration must be measured (see FT 2000). For sources other than drinking water (e.g., chlorinated effluent), 10 mg sodium thiosulfate per 40 mL vial will remove up to 5 ppm Cl_2 .

3.3. Acid Preservation

3.3.1. Chlorinated Samples

3.3.1.1. If acid preservation is required, carefully fill the vial with sample, but not to a convex meniscus as described in section 2.5.1 above.

3.3.1.2. Add four drops of concentrated HCl (more acid may be needed if the sample is known to contain high levels of bicarbonate or is otherwise buffered).

3.3.1.3. Add additional sample to create a convex meniscus.

NOTE: If the sample reacts with the acid by generating gas, do not submit preserved samples for analysis. Instead, collect unpreserved samples (seven-day holding time must be met).

3.3.2. Unchlorinated Samples

3.3.2.1. The laboratory may supply vials with premeasured quantities of acid. In this case, proceed to section 2.5.1 above. If a vial overflows during the filling process, document the problem and notify the laboratory that the vial may not contain sufficient acid.

3.3.2.2. If the samples are preserved in the field, follow the procedure in section 3.3 above.

4. CAPPING THE VIAL

4.1. Fill the vial so that the sample surface is above the container rim (convex meniscus).

4.1.1. **Do not pour** sample into cap.

4.1.2. Fill vial from the original source (tubing, spigot, etc.) **Do not fill vial from sample collected in the cap.**

4.2. **Immediately** cap the vial with the Teflon seal contacting the sample. Some sample may overflow while tightening the cap.

4.3. If acid has been added to the sample, tip the vial gently two or three times to distribute the preservative.

4.4. Turn the vial over and tap it to check for the presence of bubbles.

4.4.1. If bubbles are present, and the total volume of the bubbles is less than 5 mm in diameter, the sample may be submitted.

4.4.2. If the total volume of the bubbles is greater than 5 mm in diameter, discard the vial and fill a new one.

4.4.3. **Do not open a vial to add additional sample.**

5. SAMPLE PACKING

5.1. Label each vial with an appropriate field ID number and preservation (e.g., preserved with acid, sodium thiosulfate/acid, etc.).

5.2. Wrap each vial in a protective material (e.g., bubble wrap).

5.3. Place the set of vials in a small, sealable, untreated plastic bag unless the laboratory supplies an alternate method of packing.

5.4. Place samples in **wet** ice within 15 minutes of sample collection (see FS 1006, section 5).

5.5. Protect samples from environmental contamination during storage and transport to the laboratory.

5.6. As an added measure, DEP recommends wrapping the set of replicate samples in bubble wrap and sealing them in a container. This procedure will add further protection from potential contamination.

6. DOCUMENTATION

6.1. Label all the vials.

6.2. Complete field records.

6.3. Make note in the field records of any samples that appear highly contaminated or appear to effervesce when acid is added.

FS 2005. *Bacteriological Sampling*

1. SAMPLE CONTAINERS

1.1. Collect the samples in properly sterilized containers.

- 1.1.1. Presterilized Whirl-pak bags (or equivalent) are generally used.
- 1.1.2. If Whirl-pak bags are not used, the sample container must have a volume of at least 125 mL.
- 1.1.3. If using bottles, the caps must be sterilized. If the caps are lined, there must be documentation to show that the liner does not produce toxic compounds when sterilized.
- 1.1.4. Bottles and caps must be sterilized according to procedures in FC 1320 or purchased presterilized from a commercial vendor.

2. SAMPLE COLLECTION PROCEDURES

- 2.1. Unless a composite is specified by permit, all samples must be grab samples.
- 2.2. Do not open the container once it has been sealed.
- 2.3. Do not rinse sample container before collecting the sample.
- 2.4. Use aseptic techniques to collect the sample:
 - 2.4.1. If an intermediate device is used, thoroughly rinse with sample water. To ensure proper rinsing, DEP recommends that microbiological samples be the last sample collected with the sampling device.
 - 2.4.2. Do not put fingers into the mouth of the container or on the interior of the cap.
 - 2.4.3. Do not disinfect the sample equipment or sampling port.
- 2.5. Rinse the sampling equipment with sample water before collecting the sample. Therefore, collect microbiological samples at the end of a sampling sequence.
- 2.6. Wells with In-Place Plumbing, Spigots and/or Faucets
 - 2.6.1. Do not disinfect the spigot with bleach, alcohol or heat. Turn on spigot and flush at maximum velocity (see FS 2310).
 - 2.6.2. After flushing, reduce the water flow to approximately 500 mL/min and allow the water to flow for a few minutes before collecting samples. If other samples (metals, nutrients, etc.) are to be collected, collect these samples first.
 - 2.6.3. **Do not stop the flow before or during the filling process.**
- 2.7. Direct Grab Sample Collection
 - 2.7.1. Hold a rigid container near the base and plunge neck downward, below the surface. Turn container until the neck points slightly upward with the mouth directed toward the current. Fill to within about 1/2 inch of the top and cap immediately.
 - 2.7.2. Whirl-pak bags (or equivalent)
 - Open the bag by zipping off the top and pulling the white tabs to open the bag. Hold the bag behind the wire ties, and plunge neck downward and up in one sweeping arc; or
 - Zip off the top of the bag. Hold bag so that the mouth and wire ties are in front of the hands and fingers. Immerse the bag, and open the bag into the current.
 - The above procedures may also be accomplished by attaching the bag to a pole.
 - 2.7.2.1. Bring the bag to the surface, and press out excess water.

2.7.2.2. Seal the bag by folding the open ends at least three times and securely twisting the wire ties.

2.8. Intermediate Device Collection

2.8.1. When using an intermediate sampling device (bailer, DO dunker, niskin bottle, etc.), obtain sufficient sample in the sample collection device to completely fill the sample container. Begin pouring sample out of the device **BEFORE** collecting into the container. Continue to pour sample out of the device, place container under flowing stream, and fill. **Do not stop the flow before or during the filling process.**

3. PRESERVATION

3.1. Preserve samples according to Tables FS 1000-4 through FS 1000-10.

3.2. Place all samples in wet ice immediately after sample collection (see FS 1006, section 5).

3.3. When the sample contains residual chlorine, add a dechlorinating agent such as sodium thiosulfate to the sample container.

3.3.1. The final concentration of sodium thiosulfate must be approximately 100 milligrams per liter (mg/L) in the sample (add 0.1 mL of a 10% solution of thiosulfate to a 125 mL sample).

3.3.2. Some vendors or laboratories provide sterile containers with premeasured amounts of dechlorinating agent. Determine if the source of the field containers already contain a dechlorinating agent.

3.3.3. **Do not use containers with dechlorinating chemicals** when collecting samples from sources that are known to be free from residual chlorine.

4. HOLDING TIME

4.1. The holding time for microbiological samples is very short. Let the laboratory know the approximate time that samples will be collected and when they are expected to be delivered to the laboratory.

4.2. The holding time begins at the time (hours and minutes) the sample is collected and ends at the time that the sample is placed on the applicable growth media.

4.3. Consult Tables FS 1000-4, -6, -8, and -9 for holding times.

5. DOCUMENTATION

5.1. Label each sample container with an appropriate field ID number.

5.2. Place samples in **wet** ice within 15 minutes of sample collection (see FS 1006, section 5).

5.3. Complete field records.

5.4. Make note in the field records of any unusual sample appearances or sampling conditions.

FS 2006. *Oil and Grease (O&G) and Total Recoverable Petroleum Hydrocarbons (TRPHs)*

1. SAMPLE CONTAINERS

1.1. Collect samples for O&G and TRPHs in 1-liter wide mouth amber glass bottles.

- 1.2. The cap must have a Teflon liner.
- 1.3. Visually inspect glass bottles and caps for defects. Do not use container if defects are present or if they do not appear clean.
2. SELECTION OF SAMPLING POINTS
 - 2.1. Oil and grease may be present in wastewater as a surface film, an emulsion, a solution, or as a combination of these forms. Since it is very difficult to collect a representative ambient sample for oil and grease analysis, the sampler must carefully evaluate the location of the sampling point.
 - 2.1.1. Select a point of greatest mixing.
 - 2.1.2. For compliance samples at a facility, collect samples from a point that best represents oil and grease concentrations.
3. SAMPLE COLLECTION PROCEDURES
 - 3.1. All samples must be grab samples.
 - 3.1.1. If composite data are required, collect individual grab samples over the specified time period.
 - 3.1.2. Submit all samples for analysis.
 - 3.1.3. Average the concentrations of the results to determine the average concentration over time.
 - 3.2. Do not collect the sample by skimming the surface.
 - 3.3. Collect a discrete sample that will be used for analysis. Do not use this sample for any other test.
 - 3.4. Remove the cap from the glass bottle without touching the interior of the container or lid.
 - 3.5. Do not rinse the sampling device or the sample container with sample water.
 - 3.6. Collect the sample directly into the container.
 - 3.6.1. If intermediate sampling equipment is needed, do not allow the sampling equipment to touch the rim of the sample container.
 - 3.6.2. Do not use automatic samplers to collect these types of samples.
 - 3.6.3. Fill the bottle with the sample water to almost full capacity.
 - 3.6.4. Add preservatives (see section 4 below).
 - 3.6.5. Quickly cap the container and tighten securely.
4. PRESERVATION
 - 4.1. Preserve the sample within 15 minutes of sample collection.
 - 4.2. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**
 - 4.3. Preserve the sample by adding an accurately measured amount of sulfuric or hydrochloric acid to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.
 - 4.3.1. Tightly cap the sample container and shake to distribute the acid.

4.3.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

4.3.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see section 4.3.2 above) until the pH has been reduced to below 2 pH units.

4.3.4. Record the total amount of acid that was added to the sample.

4.4. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

4.5. After the sample has been preserved, screw the cap on tightly.

4.6. Immediately place the sample in **wet** ice after preserving with acid (see FS 1006, section 5).

5. DOCUMENTATION

5.1. Label each vial with an appropriate field ID number.

5.2. Protect glass container from breakage ("bubble wrap" is recommended).

5.3. Complete field records.

5.4. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2007. *Radiological Sampling (Excludes Radon)*

1. SAMPLE CONTAINERS

1.1. Use polyethylene, polyvinyl chloride (PVC), or Teflon containers.

1.2. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

2. SAMPLE COLLECTION PROCEDURES

2.1. On unknown sites, survey the area with a beta-gamma survey instrument, such as a Geiger-Müller meter.

2.1.1. If radiation levels are above instrument background, consult a radiation safety specialist to determine appropriate safety procedures.

2.2. Remove the cap from the sample container and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Preserve the sample with a suitable grade of nitric acid (HNO₃).

3.2. Preserve the sample within 15 minutes of sample collection.

3.3. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

3.4. If the preservative is added after the sample is collected (the container is not prepreserved), do not fill the container to the rim.

3.5. Preserve the sample by adding an accurately measured volume of concentrated HNO_3 or 1:1 HNO_3 to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

3.5.1. Tightly cap the sample container and shake to distribute the acid.

3.5.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

3.5.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see section 3.5.2 above) until the pH has been reduced to just below 2 pH units.

3.5.4. Record the total amount of acid that was added to the sample.

3.5.5. Cooling to 4°C is not required.

3.6. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

3.7. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2008. *Radon Sampling*

Radon is a gas and is easily removed from water sources. Therefore, follow the same precautions and care used to collect volatile organic samples. Minimize contact with air during sample collection. Other sample collection techniques may be appropriate, depending on the analytical method or as specified in the project data quality objectives.

1. SAMPLE CONTAINERS

1.1. Use glass sample vials containing a premeasured portion of the scintillation "cocktail."

1.2. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

1.3. Collect at least two samples.

2. PRESERVATION: The scintillation cocktail is the only required preservative.

3. SAMPLE COLLECTION PROCEDURES Obtain specific sample collection instructions from the laboratory that will analyze the samples. These instructions must include proper handling as well as sample size and packing instructions. The following are general instructions for collecting the samples:

3.1. Carefully fill a syringe (usually 10 mL) with sample water so that air bubbles are not pulled in with the sample before, during or after filling.

3.2. Place the tip of the syringe **BELOW** the scintillation cocktail and slowly dispense the sample **BENEATH** the cocktail surface.

- 3.3. Replace the lid and cap tightly.
 - 3.4. Generally, the vial is used in the laboratory analytical instrument and labels or ID numbers on the sides of the containers may interfere with the analysis. Check with the laboratory for proper placement of labels or field ID numbers.
 - 3.5. Ship in an upright position in the shipping containers that have been provided by the laboratory. If none are provided, protect vials from breakage ("bubble wrap" is recommended), segregate replicate samples in separate plastic bags, and ship to the laboratory in an upright position.
4. DOCUMENTATION
 - 4.1. Complete the field notes.
 - 4.2. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2009. *Cyanide Sampling*

Cyanide is a very reactive and unstable species and is highly toxic. Samples suspected of containing cyanide must be handled very carefully.

1. SAMPLE CONTAINERS
 - 1.1. Use polyethylene or glass sample containers.
 - 1.2. Use properly cleaned containers (see FC 1300).
 - 1.3. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.
2. SAMPLE COLLECTION PROCEDURES
 - 2.1. Remove the cap from the sample container, and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.
3. PRESERVATION
 - 3.1. Many different analytes interfere with the cyanide analysis (e.g., sulfides). If any interferences are known to be present, pretreat the sample for interferences by following the applicable footnotes in Table FS 1000-4.
 - 3.2. Preserve the sample within 15 minutes of sample collection.
 - 3.3. Preserve samples with sodium hydroxide to a pH greater than 12.
 - 3.4. Preserve the sample by adding an accurately measured amount of a sodium hydroxide solution or sodium hydroxide pellets to the container. Use a graduated container or pipet to add the solution.
 - 3.4.1. Tightly cap the sample container and shake to distribute the preservative.
 - 3.4.2. Pour an aliquot of the preserved sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is greater than 12. **Do not put the pH paper directly into the sample container.**
 - 3.4.3. If the pH is less than 12, add additional measured amounts of the preservative and test with narrow range pH paper (see section 3.4.2 above) until the pH has been raised to above 12 pH units.

- 3.4.4. Record the total amount of preservative that was added to the sample.
- 3.5. After the sample has been preserved, screw the cap on tightly.
- 3.6. Immediately put the sample in **wet** ice (see FS 1006, section 5).
- 3.7. Preserve at least one of the equipment blanks with all the reagents and the **greatest** amount of sodium hydroxide that was required in the sample set and note the amount in field documentation.
4. DOCUMENTATION
 - 4.1. Complete the sample container label and stick firmly on the container.
 - 4.2. Complete the field notes.
 - 4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.
 - 4.4. Ensure that all preservation measures are part of the field notes.

FS 2010 *Sulfide Sampling*

1. Analyze samples within 15 minutes of collection, or the preserve the sample within 15 minutes for later analysis. If preservation is required add the zinc acetate and sodium hydroxide to the container **before** filling with sample.
2. Avoid aerating the sample during collection. Slowly pour the sample slowly and carefully allow the sample to flow down the **side** of the container to minimize turbulence.
3. Check the pH (if necessary) before completing the filling process.
4. Complete the filling process. **Do not leave a head space.**

FS 2200. Groundwater Sampling

1. INTRODUCTION AND SCOPE

1.1 Use these Standard Operating Procedures to collect groundwater samples. They are designed to ensure that the collected samples will be representative of water in the aquifer or target formation and that the samples have not been altered or contaminated by the sampling and handling procedures. These procedures apply to permanently and temporarily installed monitoring wells, wells constructed using “direct-push” techniques, wells with installed plumbing, remedial groundwater treatment systems and excavations where groundwater is present. Use of alternative, DEP-approved and properly documented procedures (e.g., Corporate SOP, ASTM Standards, alternative equipment, etc.) is acceptable if they meet the intent (e.g., sample representativeness and integrity) of this standard (see FA 1000).

1.2 The topics in this SOP include equipment and supply selection, equipment construction materials, and purging and sampling techniques.

1.3 Use the following DEP SOPs in conjunction with FS 2200:

- FA 1000 Regulatory Scope and Administrative Procedures for Use of DEP SOPs
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FS 2000 General Aqueous Sampling
- FT 1000 Field Testing and Measurement
- FT 1100 Field pH
- FT 1200 Field Specific Conductance
- FT 1400 Field Temperature
- FT 1500 Field Dissolved Oxygen
- FT 1600 Field Turbidity

2. Groundwater samples may be collected from a number of different configurations. Each configuration is associated with a unique set of sampling equipment requirements and techniques:

3. Wells without Plumbing: These wells require that equipment be brought to the well to purge and sample unless dedicated equipment is placed in the well.

4. Wells with In-Place Plumbing: Wells with in-place plumbing do not require that equipment be brought to the well to purge and sample. In-place plumbing is generally considered permanent equipment routinely used for purposes other than purging and sampling, such as for water supply. They are generally found at wellfields, industrial facilities, and private residences. See FS 2300 for procedures to sample potable water wells. Air Strippers or Remedial Systems: These types of systems are installed as remediation devices. Sample these wells like drinking water wells (see FS 2300).

FS 2201 *Equipment and Supplies*

Use groundwater purging and sampling equipment constructed of only non-reactive, non-leachable materials that are compatible with the environment and the selected analytes. In selecting groundwater purging and sampling equipment, give consideration to the depth of the well, the depth to groundwater, the volume of water to be evacuated, the sampling and purging technique, and the analytes of interest. Refer to Tables FS 1000-1, FS 1000-2, FS 1000-3 and FS 2200-1 for selection of appropriate equipment.

Additional supplies such as reagents, preservatives, and field measurement equipment are often necessary.

1. **FLOW CONTAINER:** DEP recommends using a flow-through cell or container when collecting measurements for purging stabilization. The design must ensure that fresh formation water continuously contacts the measuring devices and does not aerate the sample or otherwise affect the groundwater properties.
2. **PUMPS:** All pumps or pump tubing must be lowered and retrieved from the well slowly and carefully to minimize disturbance to the formation water. This is especially critical at the air/water interface. Avoid the resuspension of sediment particles (turbidity) at the bottom of the well or adhered to the well casing during positioning of the pump or tubing.

2.1 Above-Ground Pumps

2.1.1 Variable Speed Peristaltic Pump: Use a variable speed peristaltic pump to purge groundwater from wells when the static water level in the well is no greater than 20-25 feet below land surface (BLS). If the water levels are deeper than 18-20 feet BLS, the pumping velocity will decrease.

2.1.1.1 A variable speed peristaltic pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.1.1.2 Most analyte groups can be sampled with a peristaltic pump if the tubing and pump configurations are appropriate. See Table FS 1000-3 for proper tubing selection and pump configurations.

2.1.2 Variable Speed Centrifugal Pump: A variable speed centrifugal pump can be used to purge groundwater from 2-inch and larger internal diameter wells. Do not use this type of pump to collect groundwater samples.

2.1.2.1 When purging is complete, do not allow the water that remains in the tubing to fall back into the well. Install a check valve at the end of the purge tubing, and withdraw the tubing slowly from the well while the pump is still running.

2.1.2.2 See Table FS 1000-3 for proper tubing selection and allowable analyte groups.

2.2 Submersible Pumps

2.2.1 Variable Speed Electric Submersible Pump: A variable speed submersible pump can be used to purge and sample groundwater from 2-inch and larger internal diameter wells.

2.2.1.1 A variable speed submersible pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or

formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.2.1.2 Make sure that the pump housing, fittings, check valves and associated hardware are constructed of stainless steel. Make sure that any other materials are compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.2.1.3 Install a check valve at the output side of the pump to prevent backflow.

2.2.1.4 If purging and sampling for organics:

- The entire length of the delivery tube must be Teflon, Polyethylene or Polypropylene (PP) tubing.
- The electrical cord must be sealed in Teflon, Polyethylene or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.
- All interior components that contact the sample water (impeller, seals, gaskets, etc.) must be constructed of stainless steel or Teflon.

2.2.2 Variable Speed Bladder Pump: A variable speed positive displacement bladder pump (no-gas contact) can be used to purge and sample groundwater from 3/4-inch and larger internal diameter wells.

2.2.2.1 A variable speed bladder pump can be used for normal purging and sampling (see FS 2213 and FS 2221), sampling low permeability aquifers or formations (see FS 2222) and collecting filtered groundwater samples (see FS 2225, section 1).

2.2.2.2 The bladder pump system is composed of the pump, the compressed air tubing, the water discharge tubing, the controller and a compressor or compressed gas supply.

2.2.2.3 The pump consists of a bladder and an exterior casing or pump body that surrounds the bladder and two (2) check valves. These parts can be composed of various materials, usually combinations of polyvinyl chloride (PVC), Teflon, Polyethylene, PP and stainless steel. Other materials must be compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.2.2.4 If purging and sampling for organics:

- The pump body must be constructed of stainless steel and the valves and bladder must be Teflon, Polyethylene or PP.
- The entire length of the delivery tube must be Teflon, Polyethylene or PP.
- Any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.
- Permanently installed pumps may have a PVC pump body as long as the pump remains in contact with the water in the well.

3. BAILERS:

3.1 Purging: DEP does not recommend using bailers for purging unless no other equipment can be used or purging with a bailer has been specifically authorized by a DEP program, permit, contract or order (see Table FS 2200-3). Use a bailer if there is non-aqueous phase liquid (free product) in the well or non-aqueous phase liquid is suspected to

be in the well. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager. If a bailer is used, follow FS 2213, section 4, with no deviations.

3.2 Sampling: Bailers may be used to routinely collect some analyte groups or under specific circumstances for other analyte groups (see Table FS 2200-3).

3.3 Construction and Type:

3.3.1 Bailers must be constructed of materials compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

3.3.2 Stainless steel, Teflon, Polyethylene and PP bailers may be used to sample all analytes.

3.3.3 Use disposable bailers when sampling grossly contaminated sample sources.

3.3.4 DEP recommends using dual check valve bailers when collecting samples.

3.3.5 Use bailers with a controlled flow bottom when collecting volatile organic samples.

3.3.6 Use bailers that can be pressurized when collecting filtered samples for metals.

3.4 Contamination Prevention:

3.4.1 Keep the bailer wrapped (foil, butcher paper, etc.) until just before use.

3.4.2 Use protective gloves to handle the bailer once it is removed from its wrapping.

3.4.3 Handle the bailer by the lanyard to minimize contact with the bailer surface.

4. LANYARDS

4.1 Lanyards must be made of non-reactive, non-leachable material such as cotton twine, nylon, or stainless steel; or, coated with Teflon, Polyethylene or PP.

4.1.1 Evaluate the appropriateness of the lanyard material with analyses of equipment blanks for the analytes of interest, as necessary.

4.2 Discard cotton twine, nylon, and non-stainless steel braided lanyards after sampling each monitoring well.

4.3 Decontaminate stainless steel, coated Teflon, Polyethylene and PP lanyards between monitoring wells (see FC 1003). They do not need to be decontaminated between purging and sampling operations.

4.4 Securely fasten lanyards to downhole equipment (bailers, pumps, etc.).

4.5 Do not allow lanyards used for downhole equipment to touch the ground surface.

FS 2210. GROUNDWATER PURGING

Perform procedures in the following sections to calculate purging parameters and to purge groundwater from monitoring wells, wells with installed plumbing, high-volume wells, air stripper systems and other remedial treatment systems.

FS 2211 *Water Level and Purge Volume Determination*

Collect representative groundwater samples from the aquifer. The amount of water that must be purged from a well is determined by the volume of water and/or field parameter stabilization.

1. GENERAL EQUIPMENT CONSIDERATIONS

1.1 Selection of appropriate purging equipment depends on the analytes of interest, the well diameter, transmissivity of the aquifer, the depth to groundwater and other site conditions.

1.2 Use a pump to purge the well.

1.3 Use a bailer if there is non-aqueous phase liquid in the well or non-aqueous phase liquid is suspected to be in the well.

1.4 Bailers may be used if approved by a DEP program, or if bailer use is specified in a permit, contract or DEP order (see Table FS 2200-3). If used, bailers must be of appropriate type and construction, and the user must follow the procedure outlined in FS 2213, section 4, with no deviations. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager. DEP does not recommend using bailers because improper bailing:

1.4.1 Introduces atmospheric oxygen which precipitates metals (i.e., iron) or causes other changes in the chemistry of the water in the sample (i.e., pH)

1.4.2 Agitates groundwater which biases volatile and semi-volatile organic analyses due to volatilization

1.4.3 Agitates the water in the aquifer and resuspends fine particulate matter

1.4.4 Surges the well, loosening particulate matter in the annular space around the well screen

1.4.5 Introduces dirt into the water column if the sides of the casing wall are scraped

2. INITIAL INSPECTION

2.1 Verify the identification of the monitoring well by examining markings, sign plates, placards or other designations.

2.2 Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well cap.

2.3 Inspect the exterior protective casing of the monitoring well for damage and document the results of the inspection if there is a problem.

2.4 It is recommended that you place a protective covering around the well head. Replace the covering if it becomes soiled or ripped.

2.5 Inspect the well lock and determine whether the cap fits tightly. Replace the cap if necessary.

3. WATER LEVEL MEASUREMENTS: Use an electronic probe or chalked tape to determine the water level.

3.1 General Procedures

Perform these steps using either the electronic probe or chalked tape method.

3.1.1 Decontaminate all equipment that will contact the groundwater in the well before use.

3.1.2 Measure the depth to groundwater from the top of well casing to the nearest 0.01 foot and always measure from the same reference point or survey mark on the well casing. If there is no reference mark, measure from the north side of the casing.

3.1.3 Record the measurement and the reference point.

3.2 Electronic Probe

3.2.1 Follow the manufacturer's instructions for use.

3.2.2 Record the measurement.

3.3 Chalked Line Method: This method is not recommended if collecting samples for organic or inorganic parameters.

3.3.1 Lower chalked tape into the well until the lower end is in the water (usually determined by the sound of the weight hitting the water).

3.3.2 Record the length of the tape relative to the reference point (see section 3.2 above).

3.3.3 Quickly remove the tape from the well.

3.3.4 Record the length of the wetted portion to the nearest 0.01 foot.

3.3.5 Determine the depth to water by subtracting the length of the wetted portion (see section 3.5.3 above) from the total length (see section 3.5.2 above). Record the result.

4. WATER COLUMN DETERMINATION

4.1 Do not determine the total depth of the well by lowering the probe to the bottom of the well immediately before purging and sampling. If the well must be sounded, delay purging and sampling activities for at least 24 hours after the well was sounded or for a time sufficient to meet the purge stabilization criterion for turbidity. Alternatively, collect samples before sounding the well.

4.2 Subtract the depth to the top of the water column from the total well depth to determine the length of the water column.

4.3 The total well depth depends on the well construction. Some wells may be drilled in areas of sinkhole or karst formations or rock leaving an open borehole. Attempt to find the total borehole depth in cases where there is an open borehole below the cased portion.

5. WELL WATER VOLUME

5.1 Calculate the total volume of water in gallons in the well using the following equation:

$$V = (0.041)d \times d \times h$$

Where: V = volume in gallons

d = well diameter in inches

h = height of the water column in feet

5.2 The total volume of water in the well may also be determined with the following equation by using a casing volume per foot factor (Gallons per Foot of Water) for the appropriate diameter well:

$$V = [\text{Gallons per Foot of Water}] \times h$$

Where: V = volume in gallons

h = height of the water column in feet

Casing Internal Diameter	Approximate Gallons per Foot of Water
0.75"	0.02
1"	0.04
1.25"	0.06
2"	0.16
3"	0.37
4"	0.65
5"	1.02
6"	1.47
12"	5.88

5.3 Record all measurements and calculations in the field records.

6. Purging Equipment Volume

Calculate the total volume of the pump, associated tubing and container that is used for in situ measurements (flow container), if used, using the following equation:

$$V = p + ((0.041)d \times d \times l) + fc$$

Where: V = volume in gallons

p = volume of pump in gallons

d = tubing diameter in inches

l = length of tubing in feet

fc = volume of flow cell in gallons

7. When collecting samples from multiple wells on a site, if the groundwater elevation data are to be used to construct groundwater elevation contour maps, all water level measurements must be taken within the same 24-hour time interval unless a shorter time period is required by a DEP program. If the site is tidally influenced, complete the water level measurements within the time frame of an incoming or outgoing tide.

FS 2212 *Well Purging Techniques*

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. The intent of proper purging is to stabilize the water level in the well and minimize the hydraulic stress to the hydrogeologic formation.

Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging completion criteria.

A flowchart which summarizes purging procedure options is presented in Figure FS 2200-2.

Select equipment using the construction and configuration requirements specified in Table FS 2200-1. See the discussions in FS 2201.

1. MEASURING THE PURGE VOLUME: The volume of water that is removed during purging must be recorded. Measure the volume during the purging operation.

1.1 Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, or

1.2 Estimate the volume based on pumping rate. Use this technique only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time or use a flow meter.

1.2.1 Calculate the amount of water that is discharged per minute:

$$D = \frac{\text{Measured amount}}{\text{Total time in minutes}}$$

1.2.2 Calculate the time needed to purge one (1) well volume or one (1) purging equipment volume:

$$\text{Time} = \frac{V}{D}$$

Where: V = well volume determined from FS 2211, section 5, or purging equipment volume

D = discharge rate calculated in section 1.2.1. above

1.2.3 Make new measurements (see section 1.2.1 above) each time the pumping rate is changed, or

1.3 Use a totalizing flow meter.

1.3.1 Record the reading on the totalizer prior to purging.

1.3.2 Record the reading on the totalizer at the end of purging.

1.3.3 Subtract the reading on the totalizer prior to purging from the reading on the totalizer at the end of purging to obtain the volume purged.

1.4 Record in the field records the times that purging begins and ends.

2. Stabilization Measurement Frequency

2.1 Begin to record stabilization measurements after pumping the minimum volume as prescribed in options 2.3 – 2.5 below. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria.

2.2 If the well screened interval is not known, use option 2.3, below.

2.3 Wells with Fully Submerged Screen and Pump or Intake Tubing Placed at the Top of the Water Column (conventional purge): Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) well volume prior to collecting measurements of the stabilization parameters. Allow at least one quarter (1/4) well volume to purge between subsequent measurements.

2.4 Wells with Fully Submerged Screen and Pump or Intake Tubing Placed Within the Screened Interval (minimizing purge volume): Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) volume of the pump, associated tubing and flow container (if used) prior to collecting measurements of the stabilization parameters. Take measurements of the stabilization parameters no sooner

than two (2) minutes apart. Purge at least three (3) volumes of the pump, associated tubing and flow container, if used, prior to collecting a sample.

If the water level drops into the screened interval during purging, lower the pump or tubing intake as in FS 2213, section 1.3 below and follow purging procedures for partially submerged well screens (2.5 below).

2.5 Wells with a Partially Submerged Well Screen: Purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) well volume prior to collecting measurements of the stabilization parameters. Take measurements of the stabilization parameters no sooner than two (2) minutes apart.

3. PURGING COMPLETION: DEP recommends the use of a flow-through container to measure the stabilization parameters discussed below. Alternatively, measure all parameters *in situ* by inserting measurement probes into the well at the depth appropriate for the purging option. Purging is considered complete if the criteria in section 3.1, 3.2 or 3.3 below are satisfied. Make every attempt to satisfy the criteria in section 3.1. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging criteria.

3.1 Three (3) consecutive measurements of the five (5) parameters listed below must be within the stated limits. The measurements evaluated must be the last three consecutive measurements taken before purging is stopped. The range between the highest and the lowest values for the last three measurements of temperature, pH and specific conductance cannot exceed the stated limits. The last three consecutive measurements of dissolved oxygen and turbidity must all be at or below the listed thresholds.

- Temperature: $\pm 0.2^{\circ} \text{C}$
- pH: ± 0.2 Standard Units
- Specific Conductance: $\pm 5.0\%$ of reading
- Dissolved Oxygen: $\leq 20\%$ Saturation
- Turbidity: ≤ 20 NTU

3.2 Naturally occurring conditions may prevent attaining the $\leq 20\%$ saturation criterion for dissolved oxygen, typically in surficial aquifers. See section 3.5, below.

3.3 Naturally occurring conditions may prevent attaining the ≤ 20 NTU criterion for turbidity. However, when collecting groundwater samples for metals or certain inorganic (e.g., phosphorus forms) or extractable organic (e.g. polynuclear aromatic hydrocarbons) chemicals, make every attempt to reduce turbidity to ≤ 20 NTU to avoid a potential turbidity-associated bias for these analytes. See section 3.5, below.

3.4 Document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.

- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.5 If the criteria in section 3.1 above for dissolved oxygen and/or turbidity cannot be met, then three (3) consecutive measurements of the five (5) parameters listed below must be within the stated limits.

3.5.1 The measurements evaluated must be the last three consecutive measurements taken before purging is stopped. The range between the highest and the lowest values for the last three measurements cannot exceed the stated limits.

- Temperature: $\pm 0.2^{\circ} \text{C}$
- pH: ± 0.2 Standard Units
- Specific Conductance: $\pm 5.0\%$ of reading
- Dissolved Oxygen: $\pm 0.2 \text{ mg/L}$ or 10%, whichever is greater
- Turbidity: $\pm 5 \text{ NTUs}$ or 10%, whichever is greater

3.5.2 Additionally, document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- A description of conditions at the site that cause the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open borehole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.5.3 If from review of the submitted data the Department determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first four (4) items are required to be submitted in future reports. However, if the Department cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first four (4) items, a description of the conditions at the site that caused the affected parameter(s) to be high is required to be submitted in future reports.

3.6 If the stabilization parameters in either section 3.1 or 3.2 cannot be met, and all attempts have been made to minimize the drawdown, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. All measurements that were made during the attempt must be documented. The sampling team leader may decide whether or

not to collect a sample or to continue purging after five (5) well volumes (conventional purge section 2.1 or 2.3 above) or five (5) volumes of the screened interval (minimizing purge volumes in section 2.2 above).

Further, the report in which the data are submitted must include the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Pump or tubing intake placement.
- Length and location of the screened interval.
- Drawdown in the well, if any.
- A description of conditions at the site that caused the dissolved oxygen to be high and/or dissolved oxygen measurements made within the screened or open borehole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that caused the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the DEP determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first four (4) items are required to be submitted in future reports. However, if the DEP cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first four (4) items, a description of the conditions at the site that caused the affected parameter(s) to be high is required to be submitted in future reports.

3.7 One fully dry purge (not recommended). This criterion applies only if purging was attempted per FS 2212, FS 2213, and section 3.4.1 below, and if it is impossible to balance the pumping rate with the rate of recharge at very low pumping rates (< 100 mL/minute).

3.7.1 If wells have previously and consistently purged dry, when purged according to FS 2212 and FS 2213, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

- 3.7.1.1 Place the pump or tubing intake within the well screened interval.
- 3.7.1.2 Use very small diameter Teflon, Polyethylene or PP tubing and the smallest possible pump chamber volume to minimize the total volume of water pumped from the well and to reduce drawdown.
- 3.7.1.3 Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.
- 3.7.1.4 Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.

- 3.7.1.5 Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).
- 3.7.1.6 Measure pH, Specific Conductance, Temperature, Dissolved Oxygen and Turbidity and begin to collect the samples (see FS 2222).
- 4. Collect samples immediately after purging is complete.
 - 4.1 The time period between completing the purge and sampling cannot exceed six (6) hours.
 - 4.2 If sample collection does not occur within one (1) hour of purging completion, re-measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity just prior to collecting the sample.
 - 4.2.1 If the measured values are not within 10 percent of the previous measurements, re-purge the well.
 - 4.2.2 See section 3.4 above when collecting samples from wells that have purged dry.

FS 2213 *Purging Wells Without Plumbing (Monitoring Wells)*

1. TUBING/PUMP PLACEMENT

- 1.1 Do not lower the pump or intake hose (tubing) to the bottom of the well. Pump or tubing placement procedures will be determined by the purging option selected in FS 2212, section 2 above or FS 2214 below.
 - 1.1.1 Minimizing Purge Volume: If the following conditions can be met, position the intake hose (tubing) or pump in the screened or open borehole interval.
 - The same pump must be used for both purging and sampling,
 - The well screen or borehole interval must be less than or equal to 10 feet, and
 - The well screen or borehole must be fully submerged.
 - 1.1.2 If the position or length of the screened interval or open borehole is unknown or estimated, place the intake hose (tubing) or pump to perform conventional purging in 1.2 below.
 - 1.1.3 Position the pump or intake hose when purging large-diameter deep wells with open boreholes using the procedure in FS 2214 below.
- 1.2 Conventional Purging: Position the pump or intake tubing in the top one foot of the water column or no deeper than necessary for the type of pump.
 - 1.2.1 If purging with a bailer, see section 4 below.
- 1.3 Partially Submerged Screened Interval: If the well screen or open borehole is partially submerged, and the pump will be used for both purging and sampling, position the pump or intake hose (tubing) in the portion of the water column within the submerged screened or open borehole interval.
 - 1.3.1 If the position or length of the screened interval or open borehole is unknown or estimated, place the intake hose (tubing) or pump to perform conventional purging in 1.2 above.
 - 1.3.2 Purge large-volume, high-recharge wells as in FS 2214 below.
 - 1.3.3 If purging with a bailer, see section 4 below.

2. NON-DEDICATED (PORTABLE) PUMPS

2.1 Variable Speed Peristaltic Pump

- 2.1.1 Install a new, 1-foot maximum length of silicone tubing in the peristaltic pump head.
- 2.1.2 Attach a short section of tubing to the discharge side of the pump-head silicone tubing and into a graduated container.
- 2.1.3 Attach one end of a length of new or precleaned transport tubing to the intake side of the pump head silicone tubing.
- 2.1.4 Place the transport tubing in the monitoring well per one of the options in FS 2213, section 1 above.
- 2.1.5 Measure the depth to groundwater at frequent intervals.
- 2.1.6 Record these measurements.
- 2.1.7 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- 2.1.8 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- 2.1.9 If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.
- 2.1.10 Record the purging rate each time the rate changes.
- 2.1.11 Measure the purge volume by one of the methods outlined in FS 2212, section 1.
- 2.1.12 Record this measurement.
- 2.1.13 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.2 Variable Speed Centrifugal Pump

- 2.2.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
- 2.2.2 Place the decontaminated suction hose so that water is always pumped from the top of the water column.
- 2.2.3 Equip the suction hose with a foot valve to prevent purge water from re-entering the well.
- 2.2.4 Measure the depth to groundwater at frequent intervals.
- 2.2.5 Record these measurements.
- 2.2.6 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- 2.2.7 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- 2.2.8 If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

- 2.2.9 Record the purging rate each time the rate changes.
- 2.2.10 Measure the purge volume by one of the methods outlined in FS 2212, section 1.
- 2.2.11 Record this measurement.
- 2.2.12 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.3 Variable Speed Electric Submersible Pump

- 2.3.1 Position fuel powered equipment downwind and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
- 2.3.2 Carefully position the decontaminated pump per one of the options in FS 2213, section 1 above.
- 2.3.3 Measure the depth to groundwater at frequent intervals.
- 2.3.4 Record these measurements.
- 2.3.5 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- 2.3.6 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- 2.3.7 If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.
- 2.3.8 Record the purging rate each time the rate changes.
- 2.3.9 Measure the purge volume by one of the methods outlined in FS 2212, section 1.
- 2.3.10 Record this measurement.
- 2.3.11 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.4 Variable Speed Bladder Pump

- 2.4.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.
- 2.4.2 Attach the tubing and carefully position the pump per one of the options in FS 2213, section 1 above.
- 2.4.3 Measure the depth to groundwater at frequent intervals.
- 2.4.4 Record these measurements.
- 2.4.5 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- 2.4.6 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.
- 2.4.7 If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.
- 2.4.8 Record the purging rate each time the rate changes.

2.4.9 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.4.10 Record this measurement.

2.4.11 Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

3. DEDICATED PORTABLE PUMPS: Place dedicated pumps per one of the options in FS 2213, section 1 above.

3.1 Variable Speed Electric Submersible Pump

3.1.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.1.2 Measure the depth to groundwater at frequent intervals.

3.1.3 Record these measurements.

3.1.4 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.1.5 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal with the recharge rate.

3.1.6 Record the purging rate each time the rate changes.

3.1.7 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.1.8 Record this measurement.

3.2 Variable Speed Bladder Pump

3.2.1 Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.2.2 Measure the depth to groundwater at frequent intervals.

3.2.3 Record these measurements.

3.2.4 Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.2.5 If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal with the recharge rate.

3.2.6 Record the purging rate each time the rate changes.

3.2.7 Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.2.8 Record this measurement.

4. BAILERS: DEP recommends against using bailers for purging except as a last contingency, or if free product is present in the well or suspected to be in the well. However, they may be used if approved by a DEP program, or specified in a permit, contract or DEP order (see Table FS 2200-3 and FS 2211, section 1.3). If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager.

4.1 Minimize handling the bailer as much as possible.

4.1.1 Remove the bailer from its protective wrapping just before use.

4.1.2 Attach a lanyard of appropriate material (see FS 2201, section 4).

- 4.1.3 Use the lanyard to move and position the bailer.
- 4.2 Lower and retrieve the bailer slowly and smoothly.
- 4.3 Lower the bailer carefully into the well to a depth approximately a foot above the water column.
 - 4.3.1 Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column. Ensure that the length of the bailer does not exceed the length of the water column.
 - 4.3.2 Allow time for the bailer to fill with aquifer water as it descends into the water column.
- 4.4 Carefully raise the bailer.
 - 4.4.1 Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.
- 4.5 Measure the purge volume by one of the methods outlined in FS 2212, section 1.
 - 4.5.1 Record the volume of the bailer.
- 4.6 Continue to carefully lower and retrieve the bailer as described above until the purging completion conditions specified in FS 2212, section 3, have been satisfied.
 - 4.6.1 Remove at least one (1) well volume before collecting measurements of the field parameters. Take each subsequent set of measurements after removing at least one quarter (1/4) well volume between measurements.

FS 2214 *Purging Large-Volume, High-Recharge Wells With Portable Pumps*

If a well originally constructed for high-flow-rate pumping will be sampled as a monitoring well, use these guidelines to develop a purging procedure applicable to the specific details of the well construction. Typical wells constructed for this purpose may be deep, large-diameter wells with a section of open borehole. Evaluate each well on a case-by-case basis and consider any available information on the construction and hydraulic performance of the well.

1. PURGING PROCEDURE

- 1.1 Place the pump at the top of the open borehole segment of the well.
- 1.2 Start purging while monitoring stabilization parameters as in FS 2212, section 3 above.
- 1.3 Purge at least one equipment volume before measuring stabilization parameters.
- 1.4 If the well is being purged for the first time using these guidelines, monitor stabilization parameters for an extended period until confident that sufficient volume has been pumped from the open borehole to draw fresh formation water into the pump tubing and flow-through container. Use the information obtained from the first-time purging of the well to determine the pumping rate and duration of purging required for future sampling events at the well.
- 1.5 Purge at least three equipment volumes before evaluating purging completion.

2. PURGING COMPLETION

2.1 Complete the purging of the well when the last three consecutive measurements of the purge stabilization parameters have met the applicable criteria specified in FS 2212, section 3 above.

3. Collect samples from the well using the procedures in FS 2221, section 1 below.

FS 2215. *Purging Wells With Plumbing (production wells or permanently installed pumps equipped with sampling ports or sampling spigots)*

Wells with in-place plumbing are commonly found at municipal water treatment plants, industrial water supplies, private residences, etc. Depending on the sampling objective for collecting samples using installed plumbing, purge the system and collect samples closest to the point of consumption, or, as close to the source well as possible. When purging is required and the purge volume of the plumbing system is not known, purge the system until the purging completion criteria in FS 2212, section 3, have been met.

1. CONTINUOUSLY RUNNING PUMPS

1.1 Select the spigot that is closest to the pump and before any storage tanks (if possible).

1.2 Remove all hoses, aerators and filters (if possible).

1.3 Open the spigot and purge at maximum flow.

1.4 If a storage tank is located between the pump and the spigot, purge the volume of the tank, lines and spigot.

1.5 If the spigot is before any storage tank, purge until sufficient volume is removed to flush the stagnant water from the spigot and the tap line to the spigot.

1.6 Reduce the flow rate to ≤ 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples. When sampling for volatile organic compounds, reduce the flow to ≤ 100 mL/minute before collecting the samples.

2. INTERMITTENTLY RUNNING PUMPS

2.1 Select the spigot that is closest to the pump and before any storage tanks (if possible).

2.2 Remove all hoses, aerators and filters (if possible).

2.3 Open the spigot and purge sufficient volume at a maximum, practical flow rate to flush the spigot and lines and until the purging completion criteria in FS 2212, section 3, have been met.

2.4 If a storage tank is located between the pump and the spigot, purge the volume of the tank, lines and spigot.

2.5 Ensure that the purge stabilization measurement of dissolved oxygen is not biased with aeration of the sample by a high flow rate in the flow-through container.

2.6 Reduce the flow rate to ≤ 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples. When sampling for volatile organic compounds, reduce the flow to ≤ 100 mL/minute before collecting the samples.

FS 2216. *Purging Airstrippers and Remedial Treatment Systems*

If collecting samples for groundwater contamination monitoring, follow FS 2215 above.

FS 2220. GROUNDWATER SAMPLING TECHNIQUES

1. Purge wells using the techniques outlined in FS 2210.
2. Replace the protective covering around the well if it is soiled or torn after completing the purging operations.
3. EQUIPMENT CONSIDERATIONS

Follow all notes and restrictions as indicated in Table FS 2200-1 and as discussed in FS 2201.

NOTE: The only pumps that are currently approved for use in collecting volatile organic samples through the pump are stainless steel and Teflon variable speed submersible pumps, stainless steel and Teflon or Polyethylene variable speed bladder pumps, and permanently installed PVC bodied pumps (variable speed bladder or submersible pumps) as long as the pump remains in contact with the water in the well at all times.

- 3.1 Collect the sample into the sample container from the sampling device. **Do not** use intermediate containers.
- 3.2 In order to avoid contaminating the sample or loss of analytes from the sample:
- 3.3 Handle the sampling equipment as little as possible.
 - 3.3.1 Minimize the equipment that is exposed to the sample.
 - 3.3.2 Minimize aeration of samples collected for VOC analysis.
 - 3.3.3 Reduce sampling pump flow rates to ≤ 100 mL/minute when collecting VOC samples.
- 3.4 Dedicated Sampling Equipment
 - 3.4.1 Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.
 - 3.4.2 Dedicated is defined as equipment that is to be used solely for one location for the life of that equipment (e.g., permanently mounted pump).
 - 3.4.3 All material construction and restrictions from Table FS 2200-1 also apply to dedicated equipment. Purchase equipment with the most sensitive analyte of interest in mind.
- 3.5 Cleaning/Decontamination
 - 3.5.1 Clean or ensure dedicated pumps are clean before installation. They do not need to be cleaned prior to each use but must be cleaned if they are withdrawn for repair or servicing.
 - 3.5.2 Clean or make sure any permanently mounted tubing is clean before installation.
 - 3.5.3 Change or clean tubing when the pump is withdrawn for servicing.
 - 3.5.4 Clean any replaceable or temporary parts as specified in FC 1000.
 - 3.5.5 Collect equipment blanks on dedicated pumping systems when the tubing is cleaned or replaced.
 - 3.5.6 Clean or ensure dedicated bailers are clean before placing them into the well.
 - 3.5.7 Collect an equipment blank on dedicated bailers before introducing them into the water column.

3.5.8 Suspend dedicated bailers above the water column if they are stored in the well.

FS 2221. *Sampling Wells Without Plumbing*

1. SAMPLING WITH PUMPS: Variable speed stainless steel and Teflon submersible pumps and stainless steel, Teflon or Polyethylene bladder pumps, and permanently installed PVC-bodied variable speed submersible or bladder pumps, as long as the pump remains in contact with the water in the well at all times, may be used to sample for all organics. The delivery tubing must be Teflon, Polyethylene or PP. **Extractable organics** may be collected through a peristaltic pump if ≤ 1 foot of silicone tubing is used in the pump head or a vacuum trap is used (see Figure FS 2200-1 for specific configuration). Follow all notes and restrictions as defined in Table FS 2200-1 and discussed in Equipment and Supplies (FS 2201) when using pumps to collect samples.

Do not lower the pump or tubing to the bottom of the well.

1.1 Peristaltic Pump

1.1.1 Volatile Organics Using Manual Fill and Drain Method: Collect volatile organics last. If the pump tubing is placed within the screened interval, the tubing cannot be reinserted into the well, and steps 1.1.1.3 through 1.1.1.6 below are prohibited.

- 1.1.1.1 Ensure that there is sufficient tubing volume to fill the requisite number of VOC vials.
- 1.1.1.2 Remove the drop tubing from the inlet side of the pump.
- 1.1.1.3 Submerge the drop tubing into the water column and allow it fill.
- 1.1.1.4 Remove the drop tubing from the well.
- 1.1.1.5 Prevent the water in the tubing from flowing back into the well.
- 1.1.1.6 Carefully allow the groundwater to drain by gravity into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be ≤ 100 mL/minute.
- 1.1.1.7 Repeat steps 1.1.1.3 - 1.1.1.6 until enough vials are filled.

1.1.2 Volatile Organics Using the Pump to Fill and Drain the Tubing: Collect volatile organics last. If the pump tubing is placed within the screened interval, the tubing cannot be reinserted into the well, and steps 1.1.2.2 through 1.1.2.8 below are prohibited.

- 1.1.2.1 Ensure that there is sufficient tubing volume to fill the requisite number of VOC vials.
- 1.1.2.2 Submerge the drop tubing into the water column.
- 1.1.2.3 Use the pump to fill the drop tubing.
- 1.1.2.4 Quickly remove the tubing from the pump.
- 1.1.2.5 Prevent the water in the tubing from flowing back into the well.
- 1.1.2.6 Remove the drop tubing from the well and fill the vials using the pump or gravity-drain methods in steps 1.1.2.7 or 1.1.2.8 below.
- 1.1.2.7 Reverse the flow on the peristaltic pump to deliver the sample into the vials at a slow, steady rate. The flow rate must be ≤ 100 mL/minute.

1.1.2.8 Or, remove the drop tubing from the inlet side of the pump and carefully allow the groundwater to drain into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be ≤ 100 mL/minute.

1.1.2.9 Repeat steps 1.1.2.2 through 1.1.2.8 until enough vials are filled.

1.1.3 Extractable Organics Collected Through Silicone Pump-Head Tubing:

1.1.3.1 Ensure that a 1-foot maximum length of new silicone tubing was installed in the peristaltic pump head assembly before the well was purged if the same pump is being used to purge and sample the well. Otherwise, install a new length of tubing as described above.

1.1.3.2 Collect extractable organic samples directly from the effluent delivery tubing (attached to discharge side of the silicone pump head tubing) into the sample container.

1.1.3.3 If there is a concern that sample analytes are absorbed, adsorbed, leached or otherwise affected or lost by pumping through the silicone pump-head tubing, sample the well using the organic trap assembly in 1.1.4 below.

1.1.4 Extractable Organics Using an Optional Organic Trap Assembly

1.1.4.1 Assemble the components of the pump and trap according to Figure FS 2200-1.

1.1.4.2 The sample container should be the trap bottle.

1.1.4.3 All equipment that contacts the groundwater **before** the sample container must be constructed of Teflon, Polyethylene, PP, stainless steel or glass, including the transport tubing to and from the sample container, the interior liner of the container cap and all fittings. **Do not use a rubber stopper as a cap.**

1.1.4.4 Connect the outflow tubing from the container to the influent side of the peristaltic pump.

1.1.4.5 Prevent the water in the down-hole delivery tubing from flowing back into the well while performing this connection.

1.1.4.6 Turn the pump on and reduce the flow rate to a smooth and even flow.

1.1.4.7 Discard a small portion of the sample to allow an air space.

1.1.4.8 Preserve (if required), label and complete the field notes.

1.1.5 Inorganics

1.1.5.1 Inorganic samples may be collected from the effluent tubing.

1.1.5.2 If samples are collected from the pump, decontaminate all tubing (including the tubing in the head) or change it between wells.

1.1.5.3 Preserve (if required), label and complete field notes.

1.2 Variable Speed Bladder Pump

1.2.1 If sampling for organics the pump body must be constructed of stainless steel and the valves and bladder must be Teflon. All tubing must be Teflon, Polyethylene, or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or made of stainless steel.

1.2.2 After purging to a smooth even flow, reduce the flow rate.

1.2.3 When sampling for volatile organic compounds, reduce the flow rate to 100 mL/minute or less, if possible.

1.3 Variable Speed Submersible Pump

1.3.1 The housing must be stainless steel.

1.3.2 If sampling for organics, the internal impellers, seals and gaskets must be constructed of stainless steel, Teflon, Polyethylene or PP. The delivery tubing must be Teflon, Polyethylene or PP and the electrical cord must be sealed in Teflon and any cabling must be sealed in Teflon or constructed of stainless steel.

1.3.3 After purging to a smooth even flow, reduce the flow rate.

1.3.4 When sampling for volatile organic compounds, reduce the flow rate to 100 mL/minute or less, if possible.

2. SAMPLING WITH BAILERS: A high degree of skill and coordination are necessary to collect representative samples with a bailer. When properly used, bailers may be used to collect samples for certain analyte groups and under specific conditions (see Table FS 2200-3). They must be of an appropriate type and construction (see FS 2201, section 3), and must be used as outlined below. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate DEP program or project manager.

2.1 General Considerations

2.1.1 Minimize handling the bailer as much as possible.

2.1.1.1 Wear sampling gloves.

2.1.1.2 Remove the bailer from its protective wrapping just before use.

2.1.1.3 Attach a lanyard of appropriate material (see FS 2201, section 4).

2.1.1.4 Use the lanyard to move and position the bailers.

2.1.2 Do not allow the bailer or lanyard to touch the ground.

2.1.3 Rinsing

2.1.3.1 If the bailer is certified precleaned, no rinsing is necessary.

2.1.3.2 If both a pump and a bailer are to be used to collect samples, rinse the exterior and interior of the bailer with sample water from the pump before removing the pump.

2.1.3.3 If the purge pump is not appropriate for collecting samples (e.g., non-inert components), rinse the bailer with by collecting a single bailer of the groundwater to be sampled. Use the technique described in section 2.2, Bailing Technique, below.

2.1.3.4 Discard the water appropriately.

2.1.3.5 **Do not** rinse the bailer if Oil & Grease, TRPHs, etc., (see FS 2006) are to be collected.

2.2 Bailing Technique

2.2.1 Collect all samples that are required to be collected with a pump before collecting samples with the bailer.

2.2.2 Raise and lower the bailer gently to minimize stirring up particulate matter in the well and the water column which can increase sample turbidity.

2.2.3 Lower the bailer carefully into the well to a depth approximately a foot above the water column. Ensure that the length of the bailer does not exceed the length of the water column.

2.2.3.1 When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached (see section 2.2.3 above).

2.2.4 Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.

2.2.5 Allow time for the bailer to fill with aquifer water as it descends into the water column.

2.2.6 Do not allow the bailer to touch the bottom of the well or particulate matter will be incorporated into the sample.

2.2.6.1 Carefully raise the bailer (see section 2.2.2 above). Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

2.2.7 Lower the bailer to approximately the same depth each time.

2.2.8 Collect the sample.

2.2.8.1 Install a device to control the flow from the bottom of the bailer and discard the first few inches of water. Reduce the flow to ≤ 100 mL/minute when collecting VOC samples.

2.2.8.2 Fill the appropriate sample containers by allowing the sample to slowly flow down the side of the container. Minimize aeration of VOC samples.

2.2.8.3 Discard the last few inches of water in the bailer.

2.2.9 Repeat steps 2.2.1 through 2.2.8.3 for additional samples.

2.2.10 Measure the DO, pH, temperature, turbidity and specific conductance after the final sample has been collected.

2.2.10.1 Record all measurements and note the time that sampling was completed.

3. SAMPLING WELLS WITH FLOATING NON-AQUEOUS PHASE LIQUID: DEP does not recommend the sampling of wells with floating non-aqueous phase liquid for trace contaminants. This concerns primarily petroleum related sites, but includes any chemical product (e.g., solvent) that floats on the water table. Sampling is acceptable if the information is to be used for the purpose of remedial design.

Sample data from such wells cannot provide useful information regarding the level of contamination. Furthermore, these wells typically do not provide legitimate data because of permanent chemical contamination from product contact with the well casing for an extended period of time.

DEP does reserve the right to require sampling of these wells, not for levels of trace contaminants, but for confirmation of an appropriate remediation technique. This type of sampling is performed **below** the non-aqueous phase layer (see section 3.2 below).

3.1 Non-Aqueous Phase Liquid Sampling: Non-aqueous phase liquid may be evident in a cased monitoring well or in an open excavation.

3.1.1 Non-aqueous phase liquid is normally sampled for two reasons:

- Documentation for its existence and thickness; and
- Determination of the type of product so that the proper analyses can be performed to determine extent. This is only feasible for relatively recent releases as it may not be possible to identify weathered product.

3.1.2 Disposable plastic (acrylic, clear PVC) bailers are recommended for sampling. Disposable Polyethylene and PP bailers are also acceptable. Other wide mouth vessels may be used for sampling non-aqueous phase liquid in an excavation.

3.1.3 Monitoring Well

3.1.3.1 If a non-aqueous phase liquid is identified in a monitoring well during the water level measurement, measure its thickness in the well. If the thickness of the non-aqueous phase liquid is greater than 0.01 foot or product globules are present, collect a sample using a precleaned disposable bailer.

3.1.3.2 Measure the product thickness to the nearest 0.01 foot after withdrawing the bailer.

3.1.3.3 Pour a portion of the product into a glass sample container.

3.1.3.4 This sample is considered a concentrated waste. Therefore, package the container in protective wrapping to prevent breakage, isolate from other samples, and ice to 4°C.

3.1.4 Excavation

3.1.4.1 If non-aqueous phase liquid is observed in an open excavation, a glass sample container or a precleaned intermediate vessel may be used to collect the sample.

3.1.4.2 Securely tie a lanyard to the container and lower it into the excavation.

3.1.4.3 Gently lower and retrieve the container so that no solid material is released or collected.

3.1.4.4 If sufficient water is available, a bailer can be used.

3.1.4.5 Although not recommended, screened casing can be placed (or augered and placed) in the bottom of the excavation and the product sampled with a bailer.

3.1.4.6 Avoid dangerous situations, such as standing too close to the edge of an excavation, riding in the backhoe bucket, or entering a trench or excavation that may collapse.

3.1.4.7 Follow all applicable OSHA regulations.

3.2 Sampling Below Product

3.2.1 This type of depth-specific sampling to attempt to sample the dissolved constituents in the water column below the product layer is performed only at the request of DEP or its designee.

3.2.2 These data provide information that helps define adequate groundwater treatment. Without these data, incorrect (and sometimes unnecessarily expensive) remediation techniques may be designed for a situation where they are not required.

3.2.3 There are some substantial logistical problems involved with sending a sampler through non-aqueous phase liquid to sample the groundwater below. Although there are some products designed specifically for this type of sampling, they are expensive and the results may not be commensurate with their cost. The use of "self-engineered" equipment or coverings may be the best option.

3.2.4 These data are only to be used for qualitative use and will aid in deciding on an appropriate remediation technique.

3.2.5 Wrapping bailers and tubing in plastic seems to be the most popular technique in getting past the product layer.

3.2.6 Although not recommended, some have wrapped submersible pumps in several layers of plastic and retrieved each layer by a separate lanyard. One suggestion would be to use a rigid piece of stainless steel tubing wrapped in plastic.

3.2.6.1 Once the covered tubing is past the layer, pull up on the plastic, piercing the plastic and exposing the (somewhat) clean tubing inlet.

3.2.6.2 Introduce the wrapped hose slowly to not entrain any more product into the dissolved layer located below.

3.2.6.3 Also, perform this procedure with a peristaltic pump or a vacuum pump linked to a trap bottle. To use this setup, the water table must be no deeper than 15-20 feet, realizing that actual sampling may be occurring several feet below the product layer.

FS 2222. *Sampling Low Permeability Aquifers or Wells That Have Purged Dry*

1. Collect the sample(s) after the well has been purged according to FS 2212, section 3.4. Minimize the amount of water removed from the well by using the same pump to purge and collect the sample. If the well has purged dry, collect samples as soon as sufficient sample water is available.
2. Measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity at the time of sample collection.
3. Advise the analytical laboratory and the client that the usual amount of sample for analysis may not be available.

FS 2223. *Sampling Wells With In-Place Plumbing*

1. If a storage tank is present, locate a cold water spigot, valve or other sampling point close to the well head between the pump and the storage tank. If there is no sampling location between the pump and the storage tank, locate the spigot, valve or other sampling point closest to the tank.
 - 1.1 Depending on the sampling objective for collecting samples using installed plumbing, purge the system and collect samples closest to the point of consumption, or, as close to the source well as possible.
2. Remove all screens or aerators and reduce the flow rate to no more than 500 mL/minute. If collecting samples for volatile organic compounds, reduce the flow rate to 100 mL/minute or less. Collect the samples directly into the appropriate containers.

FS 2224. *Sampling Airstripper and Remedial Treatment System Sampling*

1. Reduce the flow rate to less than 500 mL/minute and begin sample collection.
2. If collecting samples for volatile organic compounds, reduce the flow rate to 100 mL/minute or less.
3. Collect the samples directly into the appropriate containers.

FS 2225. *Filtering Groundwater Samples*

Filtered groundwater samples can only be collected after approval from the DEP program or project manager. If filtering is approved, the DEP program or permit condition may require both filtered and unfiltered samples to be collected, analyzed and reported.

1. FILTERING GROUNDWATER FOR METALS:

1.1 Unless specified otherwise by the DEP program, use a new, disposable, high capacity, 1- μ m in-line filter.

1.2 Use a variable speed peristaltic, bladder or submersible pump with the in-line filter fitted on the outlet end.

1.2.1 Peristaltic pumps, bladder pumps or submersible pumps can be used when water levels are no greater than 20 to 25 feet deep.

1.2.2 Bladder pumps or submersible pumps must be used when water levels are greater than 20 to 25 feet deep.

1.3 Ensure that a 1-foot maximum length of new, silicone tubing was installed in the peristaltic pump head assembly before the well was purged if the same pump is being used to purge and sample the well. Otherwise, install a new length of tubing as described above.

1.4 Ensure that new or precleaned delivery tubing was assembled with the peristaltic pump before the well was purged if the same pump is being used to purge and sample the well. Otherwise, assemble the pump with new or precleaned delivery tubing and the new filter.

1.5 Insert the filter on the high pressure side (i.e., on the delivery side) of the pump.

1.5.1 Flush the filter before attaching to the pump tubing assembly with 30-50 mL of analyte free water or an inert gas (nitrogen) to remove atmospheric oxygen;

1.5.2 Or, with the filter attached to the pump tubing assembly, hold the filter upright with the inlet and outlet in the vertical position and pump water from the aquifer through the filter until all atmospheric oxygen has been removed.

1.6 Collect the filtered samples directly into the sample container from the high-pressure (delivery) side of the pump tubing assembly.

1.6.1 Collect filtered samples by either of the methods in 1.6.1.3 or 1.6.1.4 below if the static water level in the well is too deep for a variable speed peristaltic pump and a variable speed electric submersible pump or variable speed bladder pump is not available.

1.6.1.1 Do not agitate the sample or expose it to atmospheric oxygen.

1.6.1.2 **Do not** pour the sample into any intermediate vessel for subsequent filtration.

1.6.1.3 Collect the sample in a Polyethylene, Teflon or PP bailer that can be pressurized. When the bailer has been retrieved, immediately connect the filter and begin to pressurize the bailer;

1.6.1.4 Or, collect the sample with a bailer and immediately place the intake tube of the peristaltic pump into the full bailer and begin pumping the water through the filter as described in section 1.2 above.

1.7 **Do not** use the following equipment for filtering groundwater samples for metals:

1.7.1 Any pump and apparatus combination in which the filter is on the vacuum (suction) side of the pump.

1.7.2 Any type of syringe or barrel filtration apparatus.

1.7.3 Any filter that is not encased in a one-piece, molded unit.

2. Filtering groundwater for non-metallic analytes

2.1 The following analytes cannot be filtered:

- Oil and Grease
- Total Recoverable Petroleum Hydrocarbons (TRPH)
- FL-PRO
- Volatile Organic Compounds (VOC)
- Microbiological Analytes
- Volatile Inorganic Compounds (e.g., Hydrogen Sulfide)

2.2 Unless specified otherwise by the regulatory program, use a new, disposable, high capacity, 0.45 µm in-line filter.

2.3 Assemble the pump, tubing and filter as in 1.2 – 1.5 above.

2.4 Flush the filter as in 1.5.1 or 1.5.2 above.

2.5 Collect the samples as in 1.6 – 1.6.1.4 above.

Appendix FS 2200
Tables, Figures and Forms

Table FS 2200-1 Equipment for Collecting Groundwater Samples

Table FS 2200-2 Dissolved Oxygen Saturation

Table FS 2200-3 Allowable Uses for Bailers

Figure FS 2200-1 Pump and Trap for Extractable Organics

Figure FS 2200-2 Groundwater Purging Procedure

Form FD 9000-24 Groundwater Sampling Log

Table FS 2200-1
Equipment for Collecting Groundwater Samples

Activity	Equipment Type
Well Purging	Variable speed centrifugal pump Variable speed submersible pump Variable speed bladder pump Variable speed peristaltic pump Bailer with lanyard: Not Recommended
Well Stabilization	pH meter DO meter Conductivity meter Thermometer/Thermistor Turbidimeter Flow-through cell Multi-function meters
Sample Collection	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Bailer with lanyard (See Table FS 2200-3)
Filtration	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Pressurized bailer 1.0 µm high capacity molded filter 0.45 µm high capacity molded filter
Groundwater Level	Electronic sensor Chalked tape

Table FS 2200-2
Dissolved Oxygen Saturation

TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L
deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%
15.0	10.084	2.017	19.0	9.276	1.855	23.0	8.578	1.716	27.0	7.968	1.594
15.1	10.062	2.012	19.1	9.258	1.852	23.1	8.562	1.712	27.1	7.954	1.591
15.2	10.040	2.008	19.2	9.239	1.848	23.2	8.546	1.709	27.2	7.940	1.588
15.3	10.019	2.004	19.3	9.220	1.844	23.3	8.530	1.706	27.3	7.926	1.585
15.4	9.997	1.999	19.4	9.202	1.840	23.4	8.514	1.703	27.4	7.912	1.582
15.5	9.976	1.995	19.5	9.184	1.837	23.5	8.498	1.700	27.5	7.898	1.580
15.6	9.955	1.991	19.6	9.165	1.833	23.6	8.482	1.696	27.6	7.884	1.577
15.7	9.934	1.987	19.7	9.147	1.829	23.7	8.466	1.693	27.7	7.870	1.574
15.8	9.912	1.982	19.8	9.129	1.826	23.8	8.450	1.690	27.8	7.856	1.571
15.9	9.891	1.978	19.9	9.111	1.822	23.9	8.434	1.687	27.9	7.842	1.568
16.0	9.870	1.974	20.0	9.092	1.818	24.0	8.418	1.684	28.0	7.828	1.566
16.1	9.849	1.970	20.1	9.074	1.815	24.1	8.403	1.681	28.1	7.814	1.563
16.2	9.829	1.966	20.2	9.056	1.811	24.2	8.387	1.677	28.2	7.800	1.560
16.3	9.808	1.962	20.3	9.039	1.808	24.3	8.371	1.674	28.3	7.786	1.557
16.4	9.787	1.957	20.4	9.021	1.804	24.4	8.356	1.671	28.4	7.773	1.555
16.5	9.767	1.953	20.5	9.003	1.801	24.5	8.340	1.668	28.5	7.759	1.552
16.6	9.746	1.949	20.6	8.985	1.797	24.6	8.325	1.665	28.6	7.745	1.549
16.7	9.726	1.945	20.7	8.968	1.794	24.7	8.309	1.662	28.7	7.732	1.546
16.8	9.705	1.941	20.8	8.950	1.790	24.8	8.294	1.659	28.8	7.718	1.544
16.9	9.685	1.937	20.9	8.932	1.786	24.9	8.279	1.656	28.9	7.705	1.541
17.0	9.665	1.933	21.0	8.915	1.783	25.0	8.263	1.653	29.0	7.691	1.538
17.1	9.645	1.929	21.1	8.898	1.780	25.1	8.248	1.650	29.1	7.678	1.536
17.2	9.625	1.925	21.2	8.880	1.776	25.2	8.233	1.647	29.2	7.664	1.533
17.3	9.605	1.921	21.3	8.863	1.773	25.3	8.218	1.644	29.3	7.651	1.530
17.4	9.585	1.917	21.4	8.846	1.769	25.4	8.203	1.641	29.4	7.638	1.528
17.5	9.565	1.913	21.5	8.829	1.766	25.5	8.188	1.638	29.5	7.625	1.525
17.6	9.545	1.909	21.6	8.812	1.762	25.6	8.173	1.635	29.6	7.611	1.522
17.7	9.526	1.905	21.7	8.794	1.759	25.7	8.158	1.632	29.7	7.598	1.520
17.8	9.506	1.901	21.8	8.777	1.755	25.8	8.143	1.629	29.8	7.585	1.517
17.9	9.486	1.897	21.9	8.761	1.752	25.9	8.128	1.626	29.9	7.572	1.514
18.0	9.467	1.893	22.0	8.744	1.749	26.0	8.114	1.623	30.0	7.559	1.512
18.1	9.448	1.890	22.1	8.727	1.745	26.1	8.099	1.620	30.1	7.546	1.509
18.2	9.428	1.886	22.2	8.710	1.742	26.2	8.084	1.617	30.2	7.533	1.507
18.3	9.409	1.882	22.3	8.693	1.739	26.3	8.070	1.614	30.3	7.520	1.504
18.4	9.390	1.878	22.4	8.677	1.735	26.4	8.055	1.611	30.4	7.507	1.501
18.5	9.371	1.874	22.5	8.660	1.732	26.5	8.040	1.608	30.5	7.494	1.499
18.6	9.352	1.870	22.6	8.644	1.729	26.6	8.026	1.605	30.6	7.481	1.496
18.7	9.333	1.867	22.7	8.627	1.725	26.7	8.012	1.602	30.7	7.468	1.494
18.8	9.314	1.863	22.8	8.611	1.722	26.8	7.997	1.599	30.8	7.456	1.491
18.9	9.295	1.859	22.9	8.595	1.719	26.9	7.983	1.597	30.9	7.443	1.489

Derived using the formula in Standard Methods for the Examination of Water and Wastewater, Page 4-101, 18th Edition, 1992

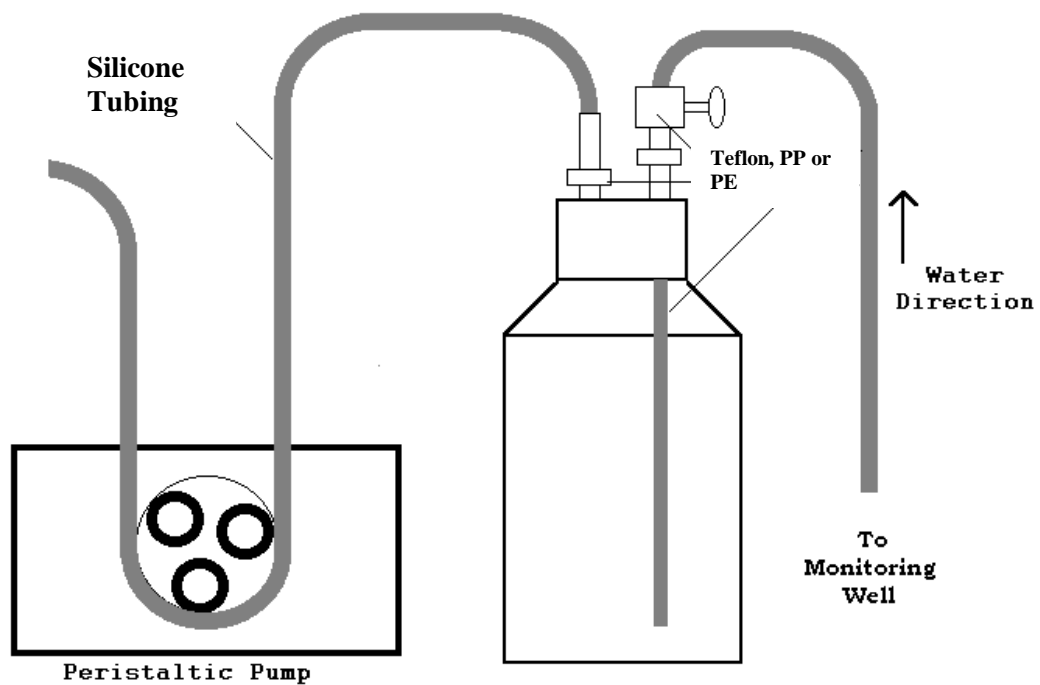
Table FS 2200-3
Allowable Uses for Bailers

• ANALYTE GROUP(S)	• PURGING (Not Recommended)	• SAMPLING	
	Use:	Use:	Not Recommended:
Volatile Organics Extractable Organics Radionuclides, including Radon Metals Volatile Sulfides	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If concentrations exceed action levels, the purpose is to monitor effective treatment, and the DEP program allows the use of bailers; or If specified by DEP permit, program, contract or order. or If operated by a skilled individual with documented training in proper techniques and using appropriate equipment. Field documentation must demonstrate that the procedure in FS 2221, section 2 was followed without deviation.	If concentrations are near or below the stated action levels; or If a critical decision (e.g., clean closure) will be made based on the data; or If data are to demonstrate compliance with a permit or order.
Petroleum Hydrocarbons (TRPH) & Oil & Grease	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	Only if allowed by permit, program, contract or order as samples should be collected into the container without intermediate devices.	Unless allowed by permit, program, contract or order.

DEP-SOP-001/01
FS 2200 Groundwater Sampling

• ANALYTE GROUP(S)	• PURGING (Not Recommended)	• SAMPLING	
	Use:	Use:	Not Recommended:
Biologicals Inorganic Non-Metallics Aggregate Organics Microbiological Physical and Aggregate Properties	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If all analytes collected from the well can be collected with a bailer; or If collected <u>after</u> collecting all analytes that require the use of a pump.	Before collecting any analytes that must be collected with a pump.
Ultra-Trace Metals	Never	Never	

Figure 2200-1
Pump and Trap for Extractable Organics



The glass sample bottle must be threaded to use a reusable sampling cap lined and installed with fittings made of Teflon, polypropylene or polyethylene, similar to the design shown.

DEP-SOP-001/01
FS 2200 Groundwater Sampling

Scenario 1: WELL SCREEN COMPLETELY SUBMERGED

Option 1a: Minimal Purge Volume: Pump or tubing is placed within the middle of the screen interval. The following conditions must be met to use this option:

1. The well screen interval is ≤ 10 feet.
2. Although drawdown may occur in the well when purging is initiated, the drawdown has to stabilize (Aquifer Recovery Rate = Purge Rate).
3. The samples will be obtained with the same equipment that was used to purge the well. Therefore, centrifugal pumps and bailers are not suitable for use in Option 1a.

If one or more of these conditions do not apply, use Option 1b.

Option 1b: Conventional Purge: Pump, tubing, or bailer¹ is placed above the screen at the top of the water column.

¹ DEP does not recommend the use of a bailer for purging; however, if a bailer is used it shall be lowered and raised at the rate of 2 cm/sec in the top of the water column.

Scenario 2: WELL SCREEN PARTIALLY SUBMERGED

Option 2a: A bailer¹ is placed at the top of the water column and is used to purge and sample the well.

Option 2b: Pump or tubing is placed within the middle of the saturated portion of the screen interval.

If the pump or tubing that was used for purging will not be used to obtain the sample, then position the pump or tubing at the top of the water column for purging.

Purging Procedure #1

1. After the drawdown in the well stabilizes, purge at least one equipment volume then collect the first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ 2 to 3 minutes apart.
3. Purge at least three equipment volumes before sampling.

Purging Procedure #2

1. Purge at least one well volume then collect first set of stabilization parameters.
2. Thereafter, collect stabilization parameters \geq every 1/4 well volume.

Purging Procedure #3

1. Purge at least one well volume then collect first set of stabilization parameters.
2. Thereafter, collect stabilization parameters ≥ 2 to 3 minutes apart.

Purging Completion

If Dissolved Oxygen is $\leq 20\%$ of saturation for the measured temperature and Turbidity is ≤ 20 NTUs, then purging is complete when **three** consecutive readings of the parameters listed below are within the following ranges:

Temperature $\pm 0.2^\circ\text{C}$
pH ± 0.2 Standard Units
Specific Conductance $\pm 5.0\%$ of reading

If Dissolved Oxygen (DO) is $> 20\%$ of saturation for the measured temperature and/or Turbidity is > 20 NTUs after every attempt has been made to reduce DO and/or turbidity, then purging is complete when **three** consecutive readings of the parameters listed below are within the following ranges:

Temperature $\pm 0.2^\circ\text{C}$
pH ± 0.2 Standard Units
Specific Conductance $\pm 5.0\%$ of reading
Dissolved Oxygen ± 0.2 mg/L or readings are within 10% (whichever is greater).
Turbidity ± 5 NTUs or readings are within 10% (whichever is greater).

If the well is expected to purge dry, position the pump or tubing within the screened interval and purge at ≤ 100 mL/minute until two equipment volumes are removed. Use the same pump for purging and sampling.

If the well purges dry at the lowest achievable flow rate (pumping at 100 mL/minute or less), then after a sufficient amount of water recharges in the well, collect the samples.

In either case listed above, before samples are collected, measure (once) pH, temperature, specific conductance, dissolved oxygen, and turbidity.

If one or more parameters do not stabilize after 5 volumes of the screened interval (purging procedure #1) or 5 well volumes (purging procedure #s 2 & 3) are removed, purging may be discontinued at the discretion of the sampling team leader.

FS 3000. SOIL

See also the following Standard Operating Procedures:

- FA 1000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FT 1000 – FT 2000 Field Testing and Calibration

1. Introduction and Scope

1.1. Use these SOPs during field investigations to collect soil samples that are representative of current site conditions. It is very important to ensure that the collected samples are neither altered nor contaminated by sampling and handling techniques.

1.2. The following topics include: equipment choice, equipment construction materials, grab and areal or depth composite sampling techniques. Sample collection methods fall into three general depth classifications: surface, shallow subsurface, and deep subsurface. Once the samples are acquired, the handling procedures are very similar and are described below.

2. GENERAL

2.1. Select sampling equipment based on the type of sample to be collected and the analytes of interest. Choose soil sampling locations such that a representative portion of the soil is collected with minimal disturbance. Locations where natural vegetation is stressed or dead and/or areas that have surficial soil staining may be indicative of improper waste disposal practices.

2.2. If background and/or quality control sampling is warranted and feasible as determined in the site's work plan or by the project manager, select an up gradient, undisturbed location for obtaining the background and/or quality control samples. Be aware that differences in soil types may affect these background samples (e.g., sands vs. clays).

2.3. **Do not collect** samples for chemical analysis from auger flights or cuttings from hollow stem auger flights, except for waste characterization purposes for disposal.

2.4. Do not use samples that are collected for geological/lithological or vapor meter determinations for chemical analyses.

3. EQUIPMENT AND SUPPLIES

3.1. All equipment must be constructed of materials consistent with the analytes of interest. Refer to FS 1000, Tables FS 1000-1, FS 1000-2 and FS 1000-3 for selection of appropriate equipment and materials.

3.2. For information on sample container size and construction, see FS 1000, Table FS 1000-6.

3.3. For information on sampling equipment cleaning requirements, see FC 1000.

3.4. For information on preservation and holding time requirements, see FS 1000, Table FS 1000-6.

3.5. For information on documentation requirements, see FD 1000.

4. PROCEDURES FOR COMPOSITING

4.1. The following is not a complete discussion regarding all available sampling protocols nor the appropriateness or inappropriateness of compositing soil samples. The appropriateness of compositing soil samples will depend on the data quality objectives of the project. However, it is sometimes advantageous to composite soil samples to minimize the number of samples to be analyzed when sampling highly contaminated areas. Obtain permission from the DEP program.

4.1.1. Select sampling points from which to collect each aliquot.

4.1.2. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.

4.1.3. **Combine the aliquots of the sample directly in the sample container with no pre-mixing.**

4.1.4. Record the amount of each aliquot (volume or weight).

4.1.5. Label container, preserve on wet ice to 4°C and complete field notes.

4.1.6. Notify the laboratory that the sample is an unmixed composite sample, and request that the sample be thoroughly mixed before sample preparation or analysis.

5. SPECIFIC PROCEDURES FOR VOLATILE ORGANIC COMPOUNDS

Follow the procedures specified in EPA Method 5035 for sample collection and sample preparation. The protocols listed below **do not replace Method 5035** but clarify and/or modify certain method procedures. Therefore, it is essential that all organizations have a copy of Method 5035 as a reference document.

5.1. Container Preparation

5.1.1. All containers must be cleaned according to the FC 1000 sample container cleaning procedures for volatile organics.

5.1.2. Sample Vials: If sample vials are filled in the field, they must be provided with all reagents, stirring devices, label **and vial cap** to be used during sample analysis. These vials must be preweighed by the laboratory and records must be maintained so that there is an unambiguous link between the tare weight and the filled sample vial.

5.2. Collection Procedure

5.2.1. The sample vials (when used) will contain a premeasured amount of liquid. The laboratory must weigh the vials before sending into the field, and must weigh them again after receipt. Therefore:

- Do not lose any of the liquid either through evaporation or spillage
- Do not use a vial if some of the contents has spilled, or if it appears that some has leaked during transport
- Use the laboratory-supplied container label for identification information. **DO NOT apply any additional labels to the container**

- Do not interchange vial caps or septa
- 5.2.2. Minimize exposure to air by obtaining the sample directly from the sample source, using a coring device or a commercially designed sampling tool.
- 5.2.2.1. The sample collection device must be designed to fit tightly against the mouth of the vial or be small enough to be inserted into the vial. Use:
- EnCore or equivalent sampling devices or
 - Disposable plastic syringes with the syringe end cut off prior to sampling (use **once** per sampling location).
- 5.2.2.2. Extrude the sample directly into the sample container.
- 5.2.3. Follow the method procedures for field transfer into the vial.
- 5.2.4. Procedures for determining the sample weight in the field are not required unless the project manager requires an accurate determination of the 5-gram sample size.
- 5.2.4.1. If the vials are returned to the laboratory for weighing, the sampler must be proficient in estimating the requisite 5-gram weight necessary for each sample.
- 5.2.4.2. If an accurate estimate of the 5-gram sample size is desired prior to starting sample collection activities, use a balance with a sensitivity of 0.1 gram. Check the balance calibration before each day's use with a set of weights that have been calibrated against NIST-traceable weights at least annually.
- 5.2.5. If the sampling device is transported to the laboratory with a sample, make sure the seals are intact, especially if collecting samples from sandy soils.
- 5.2.6. Collect at least two replicate samples from the same soil stratum and within close proximity to the original sample location.
- 5.2.7. Collect an additional aliquot of sample for screening and dry weight determinations.
- 5.3. Preservation (see FS 1000, Table FS 1000-7)
- 5.3.1. Low Level (≤ 200 $\mu\text{g/kg}$ volatile organics)
- 5.3.1.1. Method 5035 discusses the use of sodium bisulfate, which is an acid. Since Florida soils contain significant amounts of calcium carbonate that reacts with acids, DEP does not recommend using this preservative.
- 5.3.1.2. Properly pack the samples (see FS 2004, section 5), and place all samples on wet ice.
- 5.3.1.3. Analyze unpreserved samples (no acid) within 48 hours.
- 5.3.1.4. Analyze acid-preserved samples within the specified 14-day holding time.
- 5.3.1.5. Analyze unpreserved samples that have been collected in a septum vial with premeasured analyte-free water within 48 hours.
- 5.3.1.6. If unpreserved samples collected in a septum vial with premeasured analyte-free water are frozen to -10°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.
- 5.3.1.7. Analyze samples that have been collected with and transported in a sealed coring device within 48 hours.

5.3.1.8. If unpreserved samples collected in a sealed coring device are extruded from the corer into an appropriate liquid and frozen to -10°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.

5.3.2. High Level (> 200 µg/kg volatile organics)

5.3.2.1. Properly pack the samples (see FS 2004, section 5), and place all samples on wet ice.

5.3.2.2. Analyze samples that have been collected with and transported in a sealed coring device within 48 hours.

5.3.2.3. If unpreserved samples collected in a sealed coring device are extruded from the corer into an appropriate liquid and stored at 4°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.

5.3.2.4. Analyze samples that that have been preserved in methanol in the field within 14-days.

6. BULK SAMPLES: The collection of bulk samples will depend on the data quality objectives of the project.

6.1. Do not composite or mix VOC samples unless required by the DEP program or if mandated by a formal DEP document (permit, order or contract).

6.2. Select sampling points from which to collect each aliquot.

6.3. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.

6.3.1. **Combine the aliquots of the sample directly in the sample container with no pre-mixing..**

6.3.2. Pack soil tightly minimizing as much headspace as possible in the sample container.

6.3.3. Cap container tightly with Teflon side facing sample.

6.4. Record the amount of each aliquot (volume or weight) in the field notes.

6.5. Label container. Refer to FS 1000, Table FS 1000-7 for preservation and holding time requirements.

6.6. Notify the laboratory that the sample is an unmixed composite sample, and request that the sample be thoroughly mixed before sample preparation or analysis.

FS 3100. Surface Soil Sampling

Surface soil is generally classified as soil between the ground surface and 6-12 inches below ground surface.

1. Remove leaves, grass and surface debris from the area to be sampled.
2. Collect samples for volatile organic analyses as described in FS 3000, section 5.
3. Select an appropriate precleaned sampling device and collect the sample.
4. Transfer the sample to the appropriate sample container.
5. Clean the outside of the sample container to remove excess soil.

6. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

FS 3200. Subsurface Soil Sampling

Interval begins at approximately 12 inches below ground surface.

FS 3210. SAMPLE COLLECTION PROCEDURE

Use the following after the desired depth has been reached by one of the methods outlined in FS 3220.

1. Collect samples for volatile organic analyses as described in FS 3000, section 5.
2. For other analyses, select an appropriate precleaned sampling device and collect the sample.
3. Transfer the sample to the appropriate sample container.
4. Clean the outside of the sample container to remove excess soil.
5. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

FS 3220. REACHING THE APPROPRIATE DEPTH

1. SHOVELS AND DIGGERS: Used for soils from approximately 12 inches to a point when using the implement becomes impractical.
 - 1.1. Dig a hole or trench to the required depth.
 - 1.2. Follow the sample collection procedures outlined in FS 3210.
2. BACKHOE: Used for soils from approximately 12 inches to a point when using the implement becomes impractical.
 - 2.1. Dig a trench to the appropriate depth.
 - 2.2. Expose the sample, in the trench, by using a precleaned spoon, spatula or equivalent to clean away the soil that came in contact with the backhoe bucket.
 - 2.3. Use a **second** precleaned utensil to actually collect the sample from the trench.
 - 2.4. Follow the procedures outlined in FS 3210 to collect the sample.
3. BUCKET AUGERS AND HOLLOW CORERS: Suitable to reach soils from approximately 12 inches to a point when using the implement becomes impractical.
 - 3.1. Push and rotate the auger into the soil until the bucket is filled.
 - 3.2. Addition of a non-contaminating sleeve may allow an undisturbed soil sample to be obtained.
 - 3.2.1. The device consists of a standard auger head with a removable sleeve, which is inserted into the auger barrel. In this case it is the sleeve, which fills with soil.
 - 3.2.2. Remove the sleeve from the auger and cap.
 - 3.3. If the auger hole is prone to collapse due to low cohesion in some soils, DEP recommends inserting a temporary rigid PVC casing into the hole. The casing prevents hole collapse and minimizes cross-contamination between soil zones as the auger is advanced.

After collecting the samples, remove the temporary casing (if used) and fill the hole filled with the excavated soil.

3.4. Remove the sample from the sampler by pushing or scraping the soil with an appropriate precleaned utensil into an appropriately precleaned tray or aluminum foil.

3.5. Remove any portion of the sample that has been disturbed and discard.

3.6. Follow the sample collection procedures outlined in FS 3210.

NOTE: If a confining layer has been breached during sampling, grout the hole to land surface with Type-1 Portland cement. This requirement may be different throughout Florida; contact the local Water Management District office for local requirements.

4. SPLIT SPOON SAMPLER: Suitable for reaching soils from approximately 12 inches to depths greater than 10 feet.

4.1. A split spoon sampler, useful for sampling unconsolidated soil, consists of two half cylinders (spoons) that fit together to form a tube approximately two feet in length and two inches in diameter.

4.1.1. The cylindrical arrangement is maintained by a retaining head and bit rings that screw on at each end of the split spoon.

4.1.2. The bit ring has beveled edges to facilitate sampling as the split spoon is forced into the ground.

4.1.3. Advance the sampler using the weight of the drilling stem and rods or a mechanical hammer.

4.1.4. Insert a catcher device in the head ring to prevent loss of unconsolidated sample during recovery.

4.2. After retrieving the split spoon sampler, expose the soil by unscrewing the bit and head rings and splitting the barrel.

4.3. If the recovery is enough to accommodate discarding a portion of the sample, discard the top and bottom two to three inches of the sample.

4.4. For volatile organic compounds collect the sample immediately from the **center portion of the split spoon** using the procedures described in FS 3000, section 5.

4.5. For other analyses, slice the sample from the center portion of the split spoon using a clean, decontaminated utensil.

4.6. Select an appropriate precleaned sampling device and collect the sample.

4.7. Transfer the sample to the appropriate sample container.

4.8. Clean the outside of the sample container to remove excess soil.

4.9. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

5. DIRECT PUSH RIGS: May be used for depths greater than 10 feet below ground surface.

5.1. Liners: The clear liners are used with direct push rigs. This method is appropriate only for unconsolidated materials. The sampling depth that can be achieved varies depending on the rig and the lithologies that are encountered. Typically, the rig operator will:

- Place the liner inside the metal probe rod
- Select a point holder with an opening appropriate for the site lithology and screw it on the probe rod
- Advance the rod a full rod length
- Retrieve the rod
- Remove the point holder
- Remove the liner, and
- Slice the liner to expose the soil.

5.2. After the liner has been sliced, follow the procedures outlined in FS 3210, collecting volatile organic samples (if needed) immediately after the liner is sliced.

5.3. If samples for organic vapor analysis screening are required, collect them by slicing the sample(s) using a clean, decontaminated utensil and place them in 8-ounce (preferred) or 16-ounce jars, immediately cover the opening with aluminum foil and screw on the lid ring. If the contamination is derived from petroleum products, it is acceptable to use a clean gloved hand to transfer the sample(s) to the sample container(s).

5.4. For other analyses, slice the sample from the center portion of the split spoon using a clean, decontaminated utensil.

5.5. Select an appropriate precleaned sampling device and collect the sample.

5.6. Transfer the sample to the appropriate sample container.

5.7. Clean the outside of the sample container to remove excess soil.

5.8. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

6. SHELBY TUBE SAMPLER

6.1. The Shelby tube sampler is used to sample unconsolidated soil and consists of a tube approximately 30 inches long and two inches (or larger) in diameter.

6.2. One end of the tube has edges beveled into a cutting edge. The other end can be mounted to an adapter, which allows attachment to the drilling rig assembly.

6.3. After drilling to the required depth with an auger or rotary drill bit, a soil sample is obtained through the auger or directly in the borehole.

6.4. Push the Shelby tube into the soil using the drilling rig's hydraulic ram or manually with a sledge hammer.

6.5. Remove the tube from the sampler head.

6.6. Extrude the sample from the Shelby tube.

6.7. Use a decontaminated utensil to remove any portion of the sample that has been disturbed.

6.8. Collect samples for volatile organics immediately from the center portion of the Shelby tube using the procedures described in FS 3000, section 5.

6.9. For other analyses, slice the sample from the center portion of the Shelby tube using a clean, decontaminated utensil.

- 6.10. Transfer the sample to the appropriate sample container.
- 6.11. Clean the outside of the sample container to remove excess soil.
- 6.12. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

7. CORE BARREL

- 7.1. A standard core barrel is utilized when consolidated samples (such as limestone or dolomite) are to be sampled.
 - 7.1.1. The core barrel is a cylinder approximately three feet long and two inches in diameter.
 - 7.1.2. The barrel has a removable head ring with small embedded diamonds which allow the device to cut through rock or consolidated soil as the drilling rods are rotated.
- 7.2. Retrieve the sample core by unscrewing the head ring and sliding the sample into a precleaned container.
- 7.3. Use a decontaminated utensil to remove any portion of the sample that has been disturbed.
- 7.4. Remove the sample from the sampler (corer) with a precleaned tool.
- 7.5. Transfer the sample to the appropriate sample container.
- 7.6. Clean the outside of the sample container to remove excess soil.
- 7.7. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

STANDARD OPERATING PROCEDURE

SOP-01

GLOBAL POSITIONING SYSTEM

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide the Field Technicians with basic instructions for operating a handheld Global Positioning System (GPS) unit allowing them to set GPS parameters in the receiver, record GPS positions on the field device, and update existing Geographic Information System (GIS) data. This SOP is specific to GIS quality data collection for Trimble-specific hardware and software.

If possible, the Trimble GeoXM or GeoXH Operators Manual should be downloaded onto the operator's personal computer for reference before or while in the field. The manual can be downloaded at <http://trl.trimble.com/docushare/dsweb/Get/Document-311749/TerraSyncReferenceManual.pdf>

Unless the operator is proficient in the setup and operation of the GPS unit, the Project Manager (or designee) should have the GPS unit shipped to the project-specific contact listed below in the Pittsburgh, Pennsylvania office at least five working days prior to field mobilization so project-specific shape files, data points, background images, and correct coordinate systems can be uploaded into the unit.

Tetra Tech NUS, Inc.
Attn: John Wright
661 Anderson Drive, Bldg #7
Pittsburgh, PA 15220

2.0 REQUIRED EQUIPMENT

The following hardware and software should be utilized for locating and establishing GPS points in the field:

2.1 Required GPS Hardware

- Hand-held GPS Unit capable of sub-meter accuracy (i.e. Trimble GeoXM or Trimble GeoXH). This includes the docking cradle, a/c adapter, stylus, and USB cable for data transfer.

Optional Accessories:

- External antenna
- Range pole
- Hardware clamp (for mounting Geo to range pole)
- GeoBeacon
- Indelible marker
- Non-metallic pin flags for temporary marking of positions

2.2 Required GPS Software

The following software is required to transfer data from the handheld GPS unit to a personal computer:

- Trimble TerraSync version 2.6 or later (pre-loaded onto GPS unit from vendor)
- Microsoft ActiveSync version 4.2 or later. Download to personal computer from:
http://www.microsoft.com/windowsmobile/en-us/downloads/eulas/eula_activesync45_1033.mspx?ProductID=76
- Trimble Data Transfer Utility (freeware version 2.1 or later). Download to personal computer from:
<http://www.trimble.com/datatransfer.shtml>

3.0 START-UP PROCEDURES

Prior to utilizing the GPS in the field, ensure the unit is fully charged. The unit may come charged from the vendor, but an overnight charge is recommended prior to fieldwork.

The Geo-series GPS units require a docking cradle for both charging and data transfer. The Geo-series GPS unit is docked in the cradle by first inserting the far domed end in the top of the cradled, then gently seating the contact end into the latch. The power charger is then connected to the cradle at the back end using the twist-lock connector. Attach a USB cable as needed between the cradle (B end) and the laptop/PC (A end).

It is recommended that the user also be familiar and check various Windows Mobile settings. One critical setting is the Power Options. The backlight should be set as needed to conserve power when not in use.

Start Up:

- 1) Power on the GPS unit by pushing the small green button located on the lower right front of the unit.

- 2) Utilizing the stylus that came with the GPS unit, launch **TerraSync** from the Windows Operating System by tapping on the start icon located in the upper left hand corner of the screen and then tap on **TerraSync** from the drop-down list.
- 3) If the unit does not default to the Setup screen, tap the Main Menu (uppermost left tab, just below the Windows icon) and select Setup.
- 4) If the unit was previously shipped to the Pittsburgh office for setup, you can skip directly to Section 4.0. However, to confirm or change settings, continue on to Section 3.1.

3.1 Confirm Setup Settings

Use the Setup section to confirm the TerraSync software settings. To open the Setup section, tap the Main Menu and select Setup.

- 1) Coordinate System
 - a. Tap on the Coordinate System.
 - b. Verify the project specs are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
Note: It is always best to utilize the Cancel tab rather than the OK tab if no changes are made since configurations are easily changed by mistake.
 - c. Tap on the Units.
 - d. Verify the user preferences are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
 - e. Tap Real-time Settings.
 - f. Verify the Real-time Settings are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
 - g. The GPS unit is now configured correctly for your specific project.

4.0 ANTENNA CONNECTION

- 1) If a connection has been properly made with the internal antenna, a satellite icon along with the number of usable satellites will appear at the top of the screen next to the battery icon. If no connection is made (e.g.: no satellite icon), tap on the GPS tab to connect antenna.
- 2) At this point the GPS unit is ready to begin collecting data.

5.0 COLLECTING NEW DATA IN THE FIELD

- 1) From the Main Menu select Data.
- 2) From the Sub Menu (located below the Data tab) select New which will bring up the New Data File menu.
- 3) An auto-generated filename appears and should be edited for your specific project. If the integral keyboard does not appear, tap the small keyboard icon at the bottom of the screen.
- 4) After entering the file name, tap Create to create the new file.
- 5) Confirm antenna height if screen appears. Antenna height is the height that the GPS unit will be held from the ground surface (Typically 3 to 4 feet).
- 6) The Choose Feature screen appears.

5.1 Collecting Features

- 1) If not already open, the Collect Feature screen can be opened by tapping the Main Menu and selecting Data. The Sub Menu should default to Collect.
- 2) **Do not begin the data logging process until you are at the specific location for which you intend to log the data.**
- 3) A known reference or two should be shot at the beginning and at the end of each day in which the GPS unit is being used. This allows for greater accuracy during post-processing of the data.
- 4) Upon arriving at the specific location, tap on Point_generic as the Feature Name.
- 5) Tap Create to begin data logging.
- 6) In the Comment Box enter sample ID or location-specific information.
- 7) Data logging can be confirmed by viewing the writing pencil icon in the upper part of the screen. Also, the logging counter will begin. As a Rule of Thumb, accumulate a minimum of 20 readings on the counter, per point, as indicated by the logging counter before saving the GPS data.

- 8) Once the counter has reached a minimum number of counts (i.e. 20), tap on OK to save the data point to the GPS unit. Confirm the feature. All data points are automatically saved within the GPS unit.
- 9) Repeat steps 2 through 8, giving each data point a unique name or number.

Note: If the small satellite icon or the pencil icon is blinking, this is an indication the GPS unit is not collecting data. A possible problem may be too few satellites. While still in data collection mode, tap on Main Menu in upper left hand corner of the screen and select Status. Skyplot will display as the default showing the number of available satellites. To increase productivity (number of usable satellites) use the stylus to move the pointer on the productivity and precision line to the left. This will decrease precision, but increase productivity. The precision and productivity of the GPS unit can be adjusted as the number of usable satellites changes throughout the day. To determine if GPS is correctly recording data, see Section 5.2.

5.2 Viewing Data or Entering Additional Data Points to the Current File

- 1) To view the stored data points in the current file, tap on the Main Menu and select Map. Stored data points for that particular file will appear. Use the +/- and <-/> icons in lower left hand corner of screen to zoom in/out and to manipulate current view.
- 2) To return to data collection, tap on the Main Menu and select Data. You are now ready to continue to collect additional data points.

5.3 Viewing Data or Entering Data Points from an Existing File

- 1) To view data points from a previous file, tap on Main Menu and select Data, then select File Manager from the Sub Menu.
- 4) Highlight the file you want to view and select Map from the Main Menu.
- 5) To add data points to this file, tap on Main Menu and select Data. Continue to collect additional data points.

6.0 NAVIGATION

This section provides instructions on navigating to saved data points in an existing file within the GPS unit.

- 1) From the Main Menu select Map.
- 2) Using the Select tool, pick the point on the map to where you want to navigate.
- 3) The location you select will have a box placed around the point.
- 4) From the Options menu, choose the Set Nav Target (aka set navigation target).
- 5) The location will now have double blue flags indicating this point is your navigation target.
- 6) From the Main Menu select Navigation.
- 7) The dial and data on this page will indicate what distance and direction you need to travel to reach the desired target.
- 8) Follow the navigation guide until you reach the point you select.
- 9) Repeat as needed for any map point by going back to Step 1.

7.0 PULLING IN A BACKGROUND FILE

This section provides instructions on pulling in a pre-loaded background file. These files are helpful in visualizing your current location.

- 1) From the Main Menu select Map, then tap on Layers, select the background file from drop down list.
- 2) Select the project-specific background file from the list of available files.
- 3) Once the selected background file appears, the operator can manipulate the screen utilizing the +/- and <-/> functions at the bottom of the screen.
- 4) In operating mode, the operator's location will show up on the background file as a floating "x".

8.0 DATA TRANSFER

This section provides instructions on how to transfer stored data on the handheld GPS unit to a personal computer. Prior to transferring data from the GPS unit to a computer, Microsoft ActiveSync and Trimble Data Transfer Utility software must be downloaded to the computer from the links provided in Section 2.2 (Required GPS Software). If a leased computer is utilized in which the operator can not download files, see the Note at the end of Section 8.0.

- 1) See Attachment A at the end of this SOP for instructions on how to transfer data from the GPS to a personal computer.

Note: If you are unable to properly transfer data from the GPS unit to a personal computer, the unit should be shipped to the project-specific contact listed in Section 1.0 where the data will be transferred and the GPS unit then shipped back to the vendor.

9.0 SHUTTING DOWN

This section provides instruction for properly shutting down the GPS unit.

- 1) When shutting down the GPS unit for the day, first click on the "X" in the upper right hand corner.
- 2) You will be prompted to ensure you want to exit TerraSync. Select Yes.
- 3) Power off the GPS unit by pushing the small green button located on the bottom face of the unit.
- 4) Place the GPS unit in its cradle to recharge the battery overnight. Ensure the green charge light is visible on the charging cradle.

ATTACHMENT A

How to Transfer Trimble GPS Data between Data Collector and PC

original 11/21/06 (5/1/08 update) – John Wright

Remember – Coordinate System, Datum, and Units are critical!!!

Trimble Data Collection Devices:

Standard rental systems include the Trimble ProXR/XRS backpack and the newer handheld GeoXT or GeoXH units. Some of the older backpack system may come with either a RECON “PDA-style” or a TSCe or TSC1 alpha-numeric style data collector.

The software on all of the above units should be Trimble TerraSync (v 2.53 or higher – current version is 3.20) and to the user should basically look and function similar. The newer units and software versions (which should always be requested when renting) include enhancements for data processing, real-time display functions, and other features.

Data Transfer:

Trimble provides a free transfer utility program to aid in the transfer of GIS and field data. The Data Transfer Utility is a standalone program that will run on a standard office PC or laptop.

To connect a field data collector such as a RECON, GeoXM, GeoXT, GeoXH, or ProXH, you must first have Microsoft ActiveSync installed to allow the PC and the data collector to talk to one another. A standard USB cable is also needed to connect the two devices.

A CD or USB drive is provided with the data collector for use in data transfer. If needed, these programs are also available without charge via the web at:

- **Trimble Data Transfer Utility** (v 1.38) program to download the RECON or GeoXH field data to your PC: <http://www.trimble.com/datatransfer.shtml>

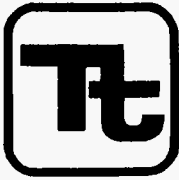
- **ActiveSync** from Microsoft to connect the data collector to the PC. The latest version (v4.5) can be found at: <http://www.microsoft.com/windowsmobile/activesync/default.mspx>
(see page 2 for data transfer instructions)

To Transfer Data Collected in the Field:

- Install the Data Transfer and ActiveSync software installed on your PC
- Connect the RECON or GeoXH to your PC via an A/B USB cable (blade end and square end type "HP printer" style)
- ActiveSync should auto-detect the connection and recognize the data collector
- Make sure the data file desired is CLOSED in TerraSync prior to transfer
- Connect via ActiveSync as a guest (not a partnership)
- Run the Trimble Data Transfer Utility program on your PC
- Select "**GIS Datalogger on Windows CE**" or similar selection
- Hit the green connect icon to the right - the far right area should say "**Connected to**" if successful
- Select the "**Receive**" data tab (under device)
- Select "**Data**" from file types on the right
- Find the file(s) needed for data transfer. You can sort the data files by clicking on the date/time header
- Select or browse to a C-drive folder you can put this file for emailing
- When the file appears on the list, hit the "**Transfer All**"
- Go to your Outlook or other email, send a message to: John.Wright@tetrattech.com (or GIS department)
- Attach the file(s) you downloaded from your C-drive. For each TerraSync data file created you should have a packet of multiple data files. All need to be sent as a group – make sure you attach all files (the number of files may vary – examples include: ssf, obx, obs, gix, giw, gis, gip, gic, dd, and car)

To Transfer GIS Data from PC to the Field Device (must be converted in Pathfinder Office):

- Obtain GIS file(s) desired from GIS Department and have converted to Trimble extension
- Contact John Wright (John.Wright@tetrattech.com) if needed for file conversion and upload support
- The GIS file(s) can be quickly converted if requested and sent back to the field user in the needed "Trimble xxx.imp" extension via email – then quickly downloaded from Outlook to your PC for transfer
- Install the Data Transfer and ActiveSync software installed on your PC
- Connect the RECON or GeoXH to your PC via an A/B USB cable (blade end and square end type "HP printer" style)
- ActiveSync should auto-detect the connection and recognize the data collector
- Connect via ActiveSync as a guest (not a partnership)
- Run the Trimble Data Transfer Utility program on your PC
- Select "**GIS Datalogger on Windows CE**" or similar selection
- Hit the green connect icon to the right - the far right area should say "**Connected to**" if successful
- Select the "**Send**" data tab (under device)
- Select "**Data**" from file types on the right (you can also send background files)
- Browse to the location of the data on your PC (obtain the file from Pathfinder Office or from the person who converted the data for field use)
- Select the options as appropriate for the name and location of the data file to go on the data collector (usually you can choose main memory or a data storage card)
- When the file(s) appears on the list, hit the "**Transfer All**"
- Run TerraSync on the field device and open the existing data files. Your transferred file should appear (make sure you have selected Main Memory, Default, or Storage Card as appropriate)



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number

CT-04

Page

1 of 6

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1

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Tetra Tech NUS, Inc.

Prepared

Risk Assessment Department

Subject

SAMPLE NOMENCLATURE

Approved

D. Senovich

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE.....	2
2.0 SCOPE.....	2
3.0 GLOSSARY	2
4.0 RESPONSIBILITIES.....	2
5.0 PROCEDURES.....	2
5.1 INTRODUCTION.....	2
5.2 SAMPLE IDENTIFICATION FIELD REQUIREMENTS.....	3
5.3 EXAMPLE SAMPLE FIELD DESIGNATIONS	4
5.4 EXAMPLES OF SAMPLE NOMENCLATURE	5
5.5 FIELD QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) SAMPLE NOMENCLATURE).....	6
5.6 EXAMPLES OF FIELD QA/QC SAMPLE NOMENCLATURE	6
6.0 DEVIATIONS	6

Subject SAMPLE NOMENCLATURE	Number CT-04	Page 2 of 6
	Revision 1	Effective Date 09/03

1.0 PURPOSE

The purpose of this document is to specify a consistent sample nomenclature system that will facilitate subsequent data management in a cost-effective manner. The sample nomenclature system has been devised such that the following objectives can be attained:

- Sorting of data by matrix.
- Sorting of data by depth.
- Maintenance of consistency (field, laboratory, and data base sample numbers).
- Accommodation of all project-specific requirements.
- Accommodation of laboratory sample number length constraints (maximum of 20 characters).

2.0 SCOPE

The methods described in this procedure shall be used consistently for all projects requiring electronic data.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Program Manager - It shall be the responsibility of the Program Manager (or designee) to inform contract-specific Project Managers of the existence and requirements of this Standard Operating Procedure.

Project Manager - It shall be the responsibility of the Project Manager to determine the applicability of this Standard Operating Procedure based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the sample nomenclature is thoroughly specified in the relevant project planning document (e.g., sampling and analysis plan) and is consistent with this Standard Operating Procedure if relevant. It shall be the responsibility of the project manager to ensure that the Field Operations Leader is familiar with the sample nomenclature system.

Field Operations Leader - It shall be the responsibility of the Field Operations Leader to ensure that all field technicians or sampling personnel are thoroughly familiar with this Standard Operating Procedure and the project-specific sample nomenclature system. It shall be the responsibility of the Field Operations Leader to ensure that the sample nomenclature system is used during all project-specific sampling efforts.

5.0 PROCEDURES

5.1 Introduction

The sample identification (ID) system can consist of as few as 8 but not more than 20 distinct alphanumeric characters. The sample ID will be provided to the laboratory on the sample labels and chain-of-custody forms. The basic sample ID provided to the lab has three segments and shall be as follows where "A" indicates "alpha," and "N" indicates "numeric":

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters
Site Identifier	Sample Type	Sample Location

Subject SAMPLE NOMENCLATURE	Number CT-04	Page 3 of 6
	Revision 1	Effective Date 09/03

Additional segments may be added as needed. For example:

(1) Soil and Sediment Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	NNNN 4-Characters
Site Identifier	Sample Type	Sample Location	Sample Depth

(2) Aqueous (groundwater or surface water) Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	NN 2-Characters	-A
Site Identifier	Sample type	Sample Location	Round Number	Filtered Sample only

(3) Biota Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	AA 2-Characters	NNN 3-Characters
Site Identifier	Sample Type	Sample Location	Species Identifier	Sample Group Number

5.2 Sample Identification Field Requirements

The various fields in the sample ID will include but are not limited to the following:

- Site Identifier
- Sample Type
- Sample Location
- Sample Depth
- Sampling Round Number
- Filtered
- Species Identifier
- Sample Group Number

The site identifier must be a three- or four-character field (numeric characters, alpha characters, or a mixture of alpha and numeric characters may be used). A site number is necessary since many facilities/sites have multiple individual sites, SWMUs, operable units, etc. Several examples are presented in Section 5.3 of this SOP.

The sample type must be a two- or three-character alpha field. Suggested codes are provided in Section 5.3 of this SOP.

The sample location must be at least a three-character field but may have up to six-characters (alpha, numeric, or a mixture). The six-characters may be useful in identifying a monitoring well to be sampled or describing a grid location.

The sample depth field is used to note the depth below ground surface (bgs) at which a soil or sediment sample is collected. The first two numbers of the four-number code specify the top interval, and the third and fourth specify the bottom interval in feet bgs of the sample. If the sample depth is equal to or greater than 100, then only the top interval would be represented and the sampling depth would be truncated to

Subject SAMPLE NOMENCLATURE	Number CT-04	Page 4 of 6
	Revision 1	Effective Date 09/03

three-characters. The depths will be noted in whole numbers only; further detail, if needed, will be recorded on the sample log sheet, boring log, logbook, etc.

A two-digit round number will be used to track the number of aqueous samples taken from a particular aqueous sample location. The first sample collected from a location will be assigned the round identifier 01, the second 02, etc. This applies to both existing and proposed monitoring wells and surface water locations.

Aqueous samples that are field filtered (dissolved analysis) will be identified with an "-F" in the last field segment. No entry in this segment signifies an unfiltered (total) sample.

The species identifier must be a two-character alpha field. Several suggested codes are provided in Section 5.3 of this SOP.

The three digit sample group number will be used to track the number of biota sample groups (a particular group size may be determined by sample technique, media type, the number of individual caught, weight issues, time, etc.) by species and location. The first sample group of a particular species collected from a given location will be assigned the sample group number 001 and the second sample group of the same species collected from the same location will be assigned the sample group number 002.

5.3 Example Sample Field Designations

Examples of each of the fields are as follows:

Site Identifier - Examples of site numbers/designations are as follows:

A01 - Area of Concern Number 1
125 - Solid Waste Management Unit Number 125
000 - Base or Facility Wide Sample (e.g., upgradient well)
BBG - Base Background

The examples cited are only suggestions. Each Project Manager (or designee) must designate appropriate (and consistent) site designations for their individual project.

Sample Type - Examples of sample types are as follows:

AH - Ash Sample
AS - Air Sample
BM - Building Material Sample
BSB - Biota Sample Full Body
BSF - Biota Sample Fillet
CP - Composite Sample
CS - Chip Sample
DS - Drum Sample
DU - Dust Sample
FP - Free Product
IDW - Investigation Derived Waste Sample
LT - Leachate Sample
MW - Monitoring Well Groundwater Sample
OF - Outfall Sample
RW - Residential Well Sample
SB - Soil Boring Sample
SD - Sediment Sample
SC - Scrape Sample

Subject SAMPLE NOMENCLATURE	Number CT-04	Page 5 of 6
	Revision 1	Effective Date 09/03

SG - Soil Gas Sample
 SL - Sludge Sample
 SP - Seep Sample
 SS - Surface Soil Sample
 ST - Storm Sewer Water Sample
 SW - Surface Water Sample
 TP - Test Pit Sample
 TW - Temporary Well Sample
 WC - Well Construction Material Sample
 WP - Wipe Sample
 WS - Waste/Solid Sample
 WW - Wastewater Sample

Sample Location - Examples of the location field are as follows:

001 - Monitoring Well 1
 N32E92 - Grid location 32 North and 92 East
 D096 - Investigation derived waste drum number 96

Species Identifier - Examples of species identifier are as follows:

BC - Blue Crab
 GB - Blue Gill
 CO - Corn
 SB - Soybean

5.4 Examples of Sample Nomenclature

The first round monitoring well groundwater sample collected from existing monitoring well 001 at SWMU 16 for a filtered sample would be designated as 016MW00101-F.

The second round monitoring well groundwater sample collected from existing monitoring well C20P2 at Site 23 for an unfiltered sample would be designated as 023MWC20P202.

The second surface water sample collected from point 01 at SWMU 130 for an unfiltered sample would be designated as 130SW00102.

A surface soil sample collected from grid location 32 North and 92 East at Site 32 at the 0- to 2-foot interval would be designated as 032SSN32E920002.

A subsurface soil sample from soil boring 03 at SWMU 32 at an interval of 4 to 5 feet bgs would be designated as 032SB0030405.

A sediment sample collected at SWMU 19 from 0 to 6 inches at location 14 would be designated as 019SD0140001. The sample data sheet would reflect the precise depth at which this sample was collected.

During biota sampling for full body analysis the first time a minnow trap was checked at grid location A25 of SWMU 1415 three small blue gills were captured, collected and designated with the sample ID of 1415BSBA25BG001. The second time blue gill were collected at the same location (grid location A25 at SWMU 1415) the sample ID designation given was 1415BSBA25BG002.

Note: No dash (-) or spacing is used between the segments with the exception of the filtered segment. The "F" used for a filtered aqueous sample is preceded by a dash "-F".

Subject SAMPLE NOMENCLATURE	Number CT-04	Page 6 of 6
	Revision 1	Effective Date 09/03

5.5 Field Quality Assurance/Quality Control (QA/QC) Sample Nomenclature)

Field QA/QC will be designated using a different coding system. The QC code will consist of a three- to four-segment alpha-numeric code that identifies the sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

AA	NNNNNN	NN	-F
QC Type	Date	Sequence Number (per day)	Filtered (aqueous only, if needed)

The QC types are identified as:

TB = Trip Blank
RB = Rinsate Blank (Equipment Blank)
FD = Field Duplicate
AB = Ambient Conditions Blank
WB = Source Water Blank

The sampling time recorded on the Chain-of-Custody Form, labels, and tags for duplicate samples will be 0000 so that the samples are "blind" to the laboratory. Notes detailing the sample number, time, date, and type will be recorded on the routine sample log sheets and will document the location of the duplicate sample (sample log sheets are not provided to the laboratory). Documentation for all other QC types (TB, RB, AB, and WB) will be recorded on the QC Sample Log sheet (see SOP on Field Documentation).

5.6 Examples of Field QA/QC Sample Nomenclature

The first duplicate of the day for a filtered ground water sample collected on June 3, 2000 would be designated as FD06030001-F.

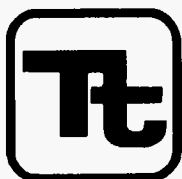
The third duplicate of the day taken of a subsurface soil sample collected on November 17, 2003 would be designated as FD11170303.

The first trip blank associated with samples collected on October 12, 2000 would be designated as TB10120001.

The only rinsate blank collected on November 17, 2001 would be designated as RB11170101.

6.0 **DEVIATIONS**

Any deviation from this SOP must be addressed in detail in the site specific planning documents.



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number

CT-05

Page

1 of 7

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Tetra Tech NUS, Inc.

Prepared

Management Information Systems Department

Subject

DATABASE RECORDS AND QUALITY ASSURANCE

Approved

D. Senovich

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE	2
2.0 SCOPE	2
3.0 GLOSSARY	2
4.0 RESPONSIBILITIES	2
5.0 PROCEDURES	4
5.1 INTRODUCTION	4
5.2 FILE ESTABLISHMENT	4
5.3 ELECTRONIC DELIVERABLES	4
5.4 SAMPLE TRACKING FORMS	5
5.5 CHAIN-OF-CUSTODY FORMS	5
5.6 DATA VALIDATION LETTERS	5
5.7 HISTORICAL DATA	5
6.0 RECORDS	6
 <u>ATTACHMENTS</u>	
A MIS REQUEST FORM	7

Subject DATABASE RECORDS AND QUALITY ASSURANCE	Number CT-05	Page 2 of 7
	Revision 2	Effective Date 01/29/01

1.0 PURPOSE

The purpose of this document is to specify a consistent procedure for the quality assurance review of electronic and hard copy databases. This SOP outlines the requirements for establishment of a Database Record File, Quality Assurance review procedures, and documentation of the Quality Assurance Review Process.

2.0 SCOPE

The methods described in this Standard Operating Procedure (SOP) shall be used consistently for all projects managed by Tetra Tech NUS (TtNUS).

3.0 GLOSSARY

Chain-of-Custody Form - A Chain-of-Custody Form is a printed form that accompanies a sample or a group of samples from the time of sample collection to the laboratory. The Chain-of-Custody Form is retained with the samples during transfer of samples from one custodian to another. The Chain-of-Custody Form is a controlled document that becomes part of the permanent project file. Chain-of-Custody and field documentation requirements are addressed in SOP SA-6.1.

Electronic Database - A database provided on a compact laser disk (CD). Such electronic databases will generally be prepared using public domain software such as DBase, RBase, Oracle, Visual FoxPro, Microsoft Access, Paradox, etc.

Hardcopy Database - A printed copy of a database prepared using the software discussed under the definition of an electronic database.

Form I - A printed copy of the analytical results for each sample.

Sample Tracking Summary - A printed record of sample information including the date the samples were collected, the number of samples collected, the sample matrix, the laboratory to which the samples were shipped, the associated analytical requirements for the samples, the date the analytical data were received from the laboratory, and the date that validation of the sample data was completed.

4.0 RESPONSIBILITIES

Database Records Custodian - It shall be the responsibility of the Database Records Custodian to update and file the Sample Tracking Summaries for all active projects on a weekly basis. It shall be the responsibility of the Database Records Custodian to ensure that the most recent copies of the Sample Tracking Summaries are placed in the Database Records file. It shall be the responsibility of the Database Records Custodian to ensure that a copy of all validation deliverables is provided to the Project Manager (for placement in the project file). It shall be the responsibility of the Database Records Custodian to ensure that photocopies of all validation deliverables and historical data and reports (as applicable) are placed in the Database Records file.

Data Validation Coordinator - It shall be the responsibility of the Data Validation Coordinator (or designee) to ensure that the Sample Tracking Summaries are maintained by the Database Records Custodian. It shall be the responsibility of the Data Validation Coordinator (or designee) to ensure that photocopies of all data validation deliverables are placed in the applicable Database Records file by the Database Records Custodian.

Subject DATABASE RECORDS AND QUALITY ASSURANCE	Number CT-05	Page 3 of 7
	Revision 2	Effective Date 01/29/01

Earth Sciences Department Manager - It shall be the responsibility of the Earth Sciences Department Manager (or equivalent) to ensure that all field personnel are familiar with the requirements of this Standard Operating Procedure (specifically Section 5.5).

FOL - It shall be the responsibility of the FOL (FOL) of each project to ensure that all field technicians or sampling personnel are thoroughly familiar with this SOP, specifically regarding provision of the Chain-of-Custody Forms to the Database Records Custodian. Other responsibilities of the FOL are described in Sections 5.4 and 5.5.

Management Information Systems (MIS) Manager - It shall be the responsibility of the MIS Manager to ensure that copies of original electronic deliverables (CDs) are placed in both the project files and the Database Records File. It shall be the responsibility of the MIS Manager (or designee) to verify the completeness of the database (presence of all samples) in both electronic and hardcopy form in the Database Records File. It shall be the responsibility of the MIS Manager to ensure that Quality Assurance Reviews are completed and are attested to by Quality Assurance Reviewers. It shall be the responsibility of the MIS Manager to ensure that records of the Quality Assurance review process are placed in the Database Records File. It shall be the responsibility of the MIS Manager to ensure that both electronic and hardcopy forms of the final database are placed in both the project and the Database Record File. It shall be the responsibility of the MIS Manager to ensure that data validation qualifiers are entered in the database.

Furthermore, it shall be the responsibility of the MIS Manager to participate in project planning at the request of the Project Manager, specifically with respect to the generation of level of effort and schedule estimates. To support the project planning effort, the MIS Manager shall provide a copy of the MIS Request Form included as Attachment A to the project manager. It shall be the responsibility of the MIS Manager to generate level of effort and budget estimates at the time database support is requested if a budget does not exist at the time of the request. The MIS Request Form shall be provided to the Project Manager at the time of any such requests. It shall be the responsibility of the MIS Manager to notify the Project Manager of any anticipated level of effort overruns or schedule noncompliances as soon as such problems arise along with full justification for any deviations from the budget estimates (provided they were generated by the MIS Manager). It shall be the responsibility of the MIS Manager to document any changes to the scope of work dictated by the Project Manager, along with an estimate of the impact of the change on the level of effort and the schedule.

Program/Department Managers - It shall be the responsibility of the Department and/or Program Managers (or designees) to inform their respective department's Project Managers of the existence and requirements of this SOP.

Project Manager - It shall be the responsibility of each Project Manager to determine the applicability of this SOP based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the FOL is familiar with the requirements regarding Chain-of-Custody Form provision to the Database Records Custodian. It shall be the responsibility of the Project Manager (or designee) to determine which, if any, historical data are relevant and to ensure that such data (including all relevant information such as originating entity, sample locations, sampling dates, etc.) are provided to the Database Records Custodian for inclusion in the Database Records File. It shall be the responsibility of the Project Manager to obtain project planning input regarding the level of effort and schedule from the MIS Manager. It shall be the responsibility of the Project Manager to complete the database checklist (Attachment A) to support the level of effort and schedule estimate and to facilitate database preparation and subroutine execution.

Risk Assessment Department Manager - It shall be the responsibility of the Risk Assessment Department Manager to monitor compliance with this Standard Operating Procedure, to modify this SOP as necessary, and to take corrective action if necessary. Monitoring of the process shall be completed on a quarterly basis.

Subject DATABASE RECORDS AND QUALITY ASSURANCE	Number CT-05	Page 4 of 7
	Revision 2	Effective Date 01/29/01

Quality Assurance Reviewers - It shall be the responsibility of the Quality Assurance Reviewers to verify the completeness of the sample results via review of the Chain-of-Custody Forms and Sample Tracking Summaries. It shall be the responsibility of the Quality Assurance Reviewers to ensure the correctness of the database via direct comparison of the hardcopy printout of the database and the hardcopy summaries of the original analytical data (e.g., Form Is provided in data validation deliverables). Correctness includes the presence of all relevant sample information (all sample information fields), agreement of the laboratory and database analytical results, and the presence of data validation qualifiers.

Quality Manager - It shall be the responsibility of the Quality Manager to monitor compliance with this Standard Operating Procedure via routine audits.

5.0 PROCEDURES

5.1 Introduction

Verification of the accuracy and completeness of an electronic database can only be accomplished via comparison of a hardcopy of the database with hardcopy of all relevant sample information. The primary purposes of this SOP are to ensure that 1) all necessary hardcopy information is readily available to Quality Assurance Reviewers; 2) ensure that the Quality Assurance review is completed in a consistent and comprehensive manner, and; 3) ensure that documentation of the Quality Assurance review process is maintained in the project file.

5.2 File Establishment

A Database Record file shall be established for a specific project at the discretion of the Project Manager. Initiation of the filing procedure will commence upon receipt of the first set of Chain-of-Custody documents from a FOL or sampling technician. The Database Record Custodian shall establish a project-specific file for placement in the Database Record File. Each file in the Database Record File shall consist of standard components placed in the file as the project progresses. Each file shall be clearly labeled with the project number, which shall be placed on the front of the file drawer and on each and every hanging file folder relevant to the project. The following constitute the minimum components of a completed file:

- Electronic Deliverables
- Sample Tracking Forms
- Chain-of-Custody Forms
- Data Validation Letters
- Quality Assurance Records

5.3 Electronic Deliverables

The format of electronic deliverables shall be specified in the laboratory procurement specification and shall be provided by the laboratory. The integrity of all original electronic data deliverables shall be maintained. This shall be accomplished via the generation of copies of each electronic deliverable provided by the laboratory. The original electronic deliverable shall be provided to the project manager for inclusion in the project file. A copy of the original electronic deliverable shall be placed in the Database Record File. The second copy shall be maintained by the MIS Manager (or designee) to be used as a working copy.

Subject DATABASE RECORDS AND QUALITY ASSURANCE	Number CT-05	Page 5 of 7
	Revision 2	Effective Date 01/29/01

5.4 Sample Tracking Forms

Updated versions of the sample tracking form for each relevant project shall be maintained by the Database Record Custodian. The Sample Tracking Forms shall be updated any time additional Chain-of-Custody Forms are received from a FOL or sampling technician, or at any time that data are received from a laboratory, or at any time that validation of a given data package (sample delivery group) is completed. The Data Validation Coordinator shall inform the Database Record Custodian of the receipt of any data packages from the laboratory and of completion of validation of a given data package to facilitate updating of the Sample Tracking Form. The Database Record Custodian shall place a revised copy of the Sample Tracking Form in the Database Record File anytime it has been updated. Copies of the updated Sample Tracking Form shall also be provided to the project manager to apprise the project manager of sample package receipt, completion of validation, etc.

5.5 Chain-of-Custody Forms

The Chain-of-Custody Forms for all sampling efforts will be used as the basis for (1) updating the Sample Tracking Form, and (2) confirming that all required samples and associated analyses have been completed. It shall be the responsibility of the FOL (or sample technician) to provide a photocopy of all Chain-of-Custody Forms to the Database Record Custodian immediately upon completion of a sampling effort. The Database Record Custodian shall then place the copies of the Chain-of-Custody Form(s) in the Database Record File. Upon receipt of a sample data package from an analytical laboratory, the Data Validation Coordinator shall provide a copy of the laboratory Chain-of-Custody Form to the Database Record Custodian. The Database Record Custodian shall use this copy to update the Sample Tracking Summary and shall place the copy of the laboratory-provided Chain-of-Custody Form in the Database Record File. The photocopy of the laboratory-provided Chain-of-Custody Form shall be stapled to the previously filed field copy. Upon receipt of all analytical data, two copies of the Chain-of-Custody will therefore be in the file. Review of the Chain-of-Custody Forms will therefore be a simple mechanism to determine if all data have been received. Chain-of-Custody is addressed in SOP SA-6.1.

5.6 Data Validation Letters

All data validation deliverables (or raw data summaries if validation is not conducted) shall be provided for inclusion in both the Database Record File and the project file. If USEPA regional- or client-specific requirements are such that Form Is (or similar analytical results) need not be provided with the validation deliverable, copies of such results must be appended to the deliverable. It is preferable, although not essential that the validation qualifiers be hand-written directly on the data summary forms. The data validation deliverables (and attendant analytical summaries) will provide the basis for direct comparison of the database printout and the raw data and qualifiers.

5.7 Historical Data

At the direction of the Project Manager, historical data may also be included in a project-specific analytical database. In the event that historical data are germane to the project, hardcopy of the historical data must be included in the Database Record File. Historical data may be maintained in the form of final reports or as raw data. The information contained in the historical data file must be sufficient to identify its origin, its collection date, the sample location, the matrix, and any and all other pertinent information. All available analytical data, Chain-of-Custody Forms, boring logs, well construction logs, sample location maps, shall be photocopied by the Project Manager (or designee) and placed in one or more 3-ring binders. All information shall be organized chronologically by matrix. It shall be the responsibility of the Project Manager (or designee) to ensure that all inconsistencies between analytical data, Chain-of-Custody Forms, boring logs, sample log sheets, and field logbooks are identified and corrected. The Project Manager (or designee) shall decide which nomenclature is appropriate and edit, initial and date all relevant forms. Data entry may only be performed on information that has undergone the aforementioned

Subject DATABASE RECORDS AND QUALITY ASSURANCE	Number CT-05	Page 6 of 7
	Revision 2	Effective Date 01/29/01

editing process, thereby having a direct correlation between hardcopy information and what will become the electronic database.

6.0 RECORDS

Records regarding database preparation and quality assurance review include all those identified in the previous section. Upon completion of the database task, records from the file will be forwarded to the Project Manager for inclusion in the project file, or will be placed in bankers boxes (or equivalent) for storage. The final records for storage shall include the following minimum information on placards placed on both the top and end of the storage box:

Database Record File
PROJECT NUMBER: ____
SITE NAME: ____
DATE FILED: __/__/____
SUMMARY OF CONTENTS ENCLOSED
BOX _ OF _

Project- or program-specific record keeping requirements shall take precedence over the record keeping requirements of this SOP.

Subject DATABASE RECORDS AND QUALITY ASSURANCE	Number CT-05	Page 7 of 7
	Revision 2	Effective Date 01/29/01

ATTACHMENT A



MIS REQUEST FORM

Tetra Tech NUS, Inc.

Project Name: _____ CTO: _____ Project Manager: _____ Requestor: _____ Program/Client: _____ State/EPA Region: _____ Site Name(s) (Area, OU, etc.): _____ Sampling Date(s): _____ Matrix: <input type="checkbox"/> GW <input type="checkbox"/> SO <input type="checkbox"/> SD <input type="checkbox"/> SW <input type="checkbox"/> Other: _____	Request Date: _____ Date Data Available for Production: _____ Request in Support of: _____ Database Lead: _____ GIS Lead: _____ Statistics Lead: _____ Risk Lead: _____
Labels: <input type="checkbox"/> Labels needed for an upcoming sampling event Total # of Samples _____ Estimated Hours Additional Instructions: _____ Due Date _____ Complete ETS Charge No. _____ _____ FOL	
Data Entry: <input type="checkbox"/> Chemical data needs to be entered from hardcopy Estimated # of Samples <input type="checkbox"/> Chemical data needs to be formatted electronically <input type="checkbox"/> Field analytical data needs to be entered from hardcopy <input type="checkbox"/> Geologic data needs to be entered from hardcopy <input type="checkbox"/> Hydrology data needs to be entered from hardcopy _____ Estimated Hours Additional Instructions: _____ Due Date _____ Complete ETS Charge No. _____	
Tables: <input type="checkbox"/> Full Data Printout <input type="checkbox"/> Summary of Positive Hits <input type="checkbox"/> Occurance and Distribution <input type="checkbox"/> with criteria <input type="checkbox"/> Sampling Analytical Summary <input type="checkbox"/> Other: _____ _____ Estimated Hours Additional Instructions: _____ Due Date _____ Complete ETS Charge No. _____	
GIS: <input type="checkbox"/> General Facility Location <input type="checkbox"/> Site Location <input type="checkbox"/> Potentiometric Contours/Groundwater Flow <input type="checkbox"/> Sample Location Proposed <input type="checkbox"/> Sample Location Existing <input type="checkbox"/> Tag Map Single Round <input type="checkbox"/> Tag Map Multiple Round <input type="checkbox"/> Isoconcentrations <input type="checkbox"/> Chart Map <input type="checkbox"/> 3D Visualization <input type="checkbox"/> EGIS CD <input type="checkbox"/> Other: _____ _____ Estimated Hours Additional Instructions: _____ Due Date _____ Complete ETS Charge No. _____	
Statistics: <input type="checkbox"/> Yes _____ Estimated Hours Additional Instructions: _____ Due Date _____ Complete ETS Charge No. _____	
Geostatistics: <input type="checkbox"/> Yes _____ Estimated Hours Additional Instructions: _____ Due Date _____ Complete ETS Charge No. _____	



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number	GH-1.5	Page	1 of 20
Effective Date	06/99	Revision	1
Applicability	Tetra Tech NUS, Inc.		
Prepared	Earth Sciences Department		
Approved	D. Senovich <i>DS</i>		

Subject

BOREHOLE AND SAMPLE LOGGING

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE	3
2.0 SCOPE	3
3.0 GLOSSARY.....	3
4.0 RESPONSIBILITIES	3
5.0 PROCEDURES	3
5.1 MATERIALS NEEDED	3
5.2 CLASSIFICATION OF SOILS	3
5.2.1 USCS Classification	6
5.2.2 Color	6
5.2.3 Relative Density and Consistency	6
5.2.4 Weight Percentages	7
5.2.5 Moisture	10
5.2.6 Stratification	10
5.2.7 Texture/Fabric/Bedding	10
5.2.8 Summary of Soil Classification	10
5.3 CLASSIFICATION OF ROCKS	13
5.3.1 Rock Type.....	13
5.3.2 Color	16
5.3.3 Bedding Thickness	16
5.3.4 Hardness	16
5.3.5 Fracturing.....	16
5.3.6 Weathering	17
5.3.7 Other Characteristics	17
5.3.8 Additional Terms Used in the Description of Rock	18
5.4 ABBREVIATIONS	19
5.5 BORING LOGS AND DOCUMENTATION	19
5.5.1 Soil Classification	19
5.5.2 Rock Classification	23
5.5.3 Classification of Soil and Rock from Drill Cuttings	24
5.6 REVIEW.....	24
6.0 REFERENCES	24
7.0 RECORDS	25

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 2 of 20
	Revision 1	Effective Date 06/99

TABLE OF CONTENTS (Continued)

FIGURES

<u>NUMBERS</u>		<u>PAGE</u>
1	BORING LOG (EXAMPLE)	4
2	CONSISTENCY FOR COHESIVE SOILS	8
3	BEDDING THICKNESS CLASSIFICATION	10
4	GRAIN SIZE CLASSIFICATION FOR ROCKS	12
5	COMPLETED BORING LOG (EXAMPLE)	17

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 3 of 20
	Revision 1	Effective Date 06/99

1.0 PURPOSE

The purpose of this document is to establish standard procedures and technical guidance on borehole and sample logging.

2.0 SCOPE

These procedures provide descriptions of the standard techniques for borehole and sample logging. These techniques shall be used for each boring logged to provide consistent descriptions of subsurface lithology. While experience is the only method to develop confidence and accuracy in the description of soil and rock, the field geologist/engineer can do a good job of classification by careful, thoughtful observation and by being consistent throughout the classification procedure.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Site Geologist. Responsible for supervising all boring activities and assuring that each borehole is completely logged. If more than one rig is being used on site, the Site Geologist must make sure that each field geologist is properly trained in logging procedures. A brief review or training session may be necessary prior to the start up of the field program and/or upon completion of the first boring.

5.0 PROCEDURES

The classification of soil and rocks is one of the most important jobs of the field geologist/engineer. To maintain a consistent flow of information, it is imperative that the field geologist/engineer understand and accurately use the field classification system described in this SOP. This identification is based on visual examination and manual tests.

5.1 Materials Needed

When logging soil and rock samples, the geologist or engineer may be equipped with the following:

- Rock hammer
- Knife
- Camera
- Dilute hydrochloric acid (HCl)
- Ruler (marked in tenths and hundredths of feet)
- Hand Lens

5.2 Classification of Soils

All data shall be written directly on the boring log (Figure 1) or in a field notebook if more space is needed. Details on filling out the boring log are discussed in Section 5.5.

FIGURE 1 (CONTINUED)

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)									
FINE-GRAINED SOILS More Than Half of Material is Larger Than No. 200 Sieve Size					FINE-GRAINED SOILS More Than Half of Material is Smaller Than No. 200 Sieve Size				
GROUP SYMBOL	FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)	TYPICAL NAMES	GROUP SYMBOL	FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)	TYPICAL NAMES	FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)			
						FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)			
						FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)			
CLAYEY SILT (CL-ML)	CLAYEY SILT (CL-ML)	CLAYEY SILT (CL-ML)	CL	CLAYEY SILT (CL-ML)	CLAYEY SILT (CL-ML)	CLAYEY SILT (CL-ML)			
						CLAYEY SILT (CL-ML)			
						CLAYEY SILT (CL-ML)			
						CLAYEY SILT (CL-ML)			
CLAYEY SILT (CL-ML)	CLAYEY SILT (CL-ML)	CLAYEY SILT (CL-ML)	CL	CLAYEY SILT (CL-ML)	CLAYEY SILT (CL-ML)	CLAYEY SILT (CL-ML)			
						CLAYEY SILT (CL-ML)			
						CLAYEY SILT (CL-ML)			
						CLAYEY SILT (CL-ML)			

Soil classification is based on the results of the following tests: Liquid Limit (LL), Plastic Limit (PL), and Shrinkage Limit (SL). The classification is based on the results of the following tests: Liquid Limit (LL), Plastic Limit (PL), and Shrinkage Limit (SL).

DENSITY OF GRANULAR SOILS		SYMBOL	FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)
DESIGNATION	SYMBOL		
Very Loose	VL		
Loose	L		
Medium Dense	MD		
Dense	D		
Very Dense	VD		

CONSISTENCY OF COHESIVE SOILS		SYMBOL	FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)
DESIGNATION	SYMBOL		
Very Soft	VS		
Soft	S		
Medium Soft	MS		
Stiff	ST		
Very Stiff	VST		
Hard	H		

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)				ROCK BROKENNESS			
DESIGNATION	SYMBOL	FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)	DESIGNATION	SYMBOL	FIELD IDENTIFICATION NOTES (Including Indications of Water Content, Liquid Limit, Plasticity, etc.)	DESIGNATION	SYMBOL
Very Soft	VS		Very Soft	VS		Very Soft	VS
Soft	S		Soft	S		Soft	S
Medium Soft	MS		Medium Soft	MS		Medium Soft	MS
Stiff	ST		Stiff	ST		Stiff	ST
Very Stiff	VST		Very Stiff	VST		Very Stiff	VST

Soil classification is based on the results of the following tests: Liquid Limit (LL), Plastic Limit (PL), and Shrinkage Limit (SL). The classification is based on the results of the following tests: Liquid Limit (LL), Plastic Limit (PL), and Shrinkage Limit (SL).

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 6 of 20
	Revision 1	Effective Date 06/99

5.2.1 USCS Classification

Soils are to be classified according to the Unified Soil Classification System (USCS). This method of classification is detailed in Figure 1 (Continued).

This method of classification identifies soil types on the basis of grain size and cohesiveness.

Fine-grained soils, or fines, are smaller than the No. 200 sieve and are of two types: silt (M) and clay (C). Some classification systems define size ranges for these soil particles, but for field classification purposes, they are identified by their respective behaviors. Organic material (O) is a common component of soil but has no size range; it is recognized by its composition. The careful study of the USCS will aid in developing the competence and consistency necessary for the classification of soils.

Coarse-grained soils shall be divided into rock fragments, sand, or gravel. The terms sand and gravel not only refer to the size of the soil particles but also to their depositional history. To insure accuracy in description, the term rock fragments shall be used to indicate angular granular materials resulting from the breakup of rock. The sharp edges typically observed indicate little or no transport from their source area, and therefore the term provides additional information in reconstructing the depositional environment of the soils encountered. When the term "rock fragments" is used it shall be followed by a size designation such as "(1/4 inch Φ -1/2 inch Φ)" or "coarse-sand size" either immediately after the entry or in the remarks column. The USCS classification would not be affected by this variation in terms.

5.2.2 Color

Soil colors shall be described utilizing a single color descriptor preceded, when necessary, by a modifier to denote variations in shade or color mixtures. A soil could therefore be referred to as "gray" or "light gray" or "blue-gray." Since color can be utilized in correlating units between sampling locations, it is important for color descriptions to be consistent from one boring to another.

Colors must be described while the sample is still moist. Soil samples shall be broken or split vertically to describe colors. Samplers tend to smear the sample surface creating color variations between the sample interior and exterior.

The term "mottled" shall be used to indicate soils irregularly marked with spots of different colors. Mottling in soils usually indicates poor aeration and lack of good drainage.

Soil Color Charts shall not be used unless specified by the project manager.

5.2.3 Relative Density and Consistency

To classify the relative density and/or consistency of a soil, the geologist is to first identify the soil type. Granular soils contain predominantly sands and gravels. They are noncohesive (particles do not adhere well when compressed). Finer-grained soils (silts and clays) are cohesive (particles will adhere together when compressed).

The density of noncohesive, granular soils is classified according to standard penetration resistances obtained from split-barrel sampling performed according to the methods detailed in Standard Operating Procedures GH-1.3 and SA-1.3. Those designations are:

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 7 of 20
	Revision 1	Effective Date 06/99

Designation	Standard Penetration Resistance (Blows per Foot)
Very loose	0 to 4
Loose	5 to 10
Medium dense	11 to 30
Dense	31 to 50
Very dense	Over 50

Standard penetration resistance is the number of blows required to drive a split-barrel sampler with a 2-inch outside diameter 12 inches into the material using a 140-pound hammer falling freely through 30 inches. The sampler is driven through an 18-inch sample interval, and the number of blows is recorded for each 6-inch increment. The density designation of granular soils is obtained by adding the number of blows required to penetrate the last 12 inches of each sample interval. It is important to note that if gravel or rock fragments are broken by the sampler or if rock fragments are lodged in the tip, the resulting blow count will be erroneously high, reflecting a higher density than actually exists. This shall be noted on the log and referenced to the sample number. Granular soils are given the USCS classifications GW, GP, GM, SW, SP, SM, GC, or SC (see Figure 1).

The consistency of cohesive soils is determined by performing field tests and identifying the consistency as shown in Figure 2.

Cohesive soils are given the USCS classifications ML, MH, CL, CH, OL, or OH (see Figure 1).

The consistency of cohesive soils is determined either by blow counts, a pocket penetrometer (values listed in the table as Unconfined Compressive Strength), or by hand by determining the resistance to penetration by the thumb. The pocket penetrometer and thumb determination methods are conducted on a selected sample of the soil, preferably the lowest 0.5 foot of the sample in the split-barrel sampler. The sample shall be broken in half and the thumb or penetrometer pushed into the end of the sample to determine the consistency. Do not determine consistency by attempting to penetrate a rock fragment. If the sample is decomposed rock, it is classified as a soft decomposed rock rather than a hard soil. Consistency shall not be determined solely by blow counts. One of the other methods shall be used in conjunction with it. The designations used to describe the consistency of cohesive soils are shown in Figure 2.

5.2.4 Weight Percentages

In nature, soils are comprised of particles of varying size and shape, and are combinations of the various grain types. The following terms are useful in the description of soil:

Terms of Identifying Proportion of the Component	Defining Range of Percentages by Weight
Trace	0 - 10 percent
Some	11 - 30 percent
Adjective form of the soil type (e.g., "sandy")	31 - 50 percent

FIGURE 2

CONSISTENCY FOR COHESIVE SOILS

Consistency	Standard Penetration Resistance (Blows per Foot)	Unconfined Compressive Strength (Tons/Sq. Foot by pocket penetration)	Field Identification
Very soft	0 to 2	Less than 0.25	Easily penetrated several inches by fist
Soft	2 to 4	0.25 to 0.50	Easily penetrated several inches by thumb
Medium stiff	4 to 8	0.50 to 1.0	Can be penetrated several inches by thumb with moderate effort
Stiff	8 to 15	1.0 to 2.0	Readily indented by thumb but penetrated only with great effort
Very stiff	15 to 30	2.0 to 4.0	Readily indented by thumbnail
Hard	Over 30	More than 4.0	Indented with difficulty by thumbnail

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 9 of 20
	Revision 1	Effective Date 06/99

Examples:

- Silty fine sand: 50 to 69 percent fine sand, 31 to 50 percent silt.
- Medium to coarse sand, some silt: 70 to 80 percent medium to coarse sand, 11 to 30 percent silt.
- Fine sandy silt, trace clay: 50 to 68 percent silt, 31 to 49 percent fine sand, 1 to 10 percent clay.
- Clayey silt, some coarse sand: 70 to 89 percent clayey silt, 11 to 30 percent coarse sand.

5.2.5 Moisture

Moisture content is estimated in the field according to four categories: dry, moist, wet, and saturated. In dry soil, there appears to be little or no water. Saturated samples obviously have all the water they can hold. Moist and wet classifications are somewhat subjective and often are determined by the individual's judgment. A suggested parameter for this would be calling a soil wet if rolling it in the hand or on a porous surface liberates water, i.e., dirties or muddies the surface. Whatever method is adopted for describing moisture, it is important that the method used by an individual remains consistent throughout an entire drilling job.

Laboratory tests for water content shall be performed if the natural water content is important.

5.2.6 Stratification

Stratification can only be determined after the sample barrel is opened. The stratification or bedding thickness for soil and rock is depending on grain size and composition. The classification to be used for stratification description is shown in Figure 3.

5.2.7 Texture/Fabric/Bedding

The texture/fabric/bedding of the soil shall be described. Texture is described as the relative angularity of the particles: rounded, subrounded, subangular, and angular. Fabric shall be noted as to whether the particles are flat or bulky and whether there is a particular relation between particles (i.e., all the flat particles are parallel or there is some cementation). The bedding or structure shall also be noted (e.g., stratified, lensed, nonstratified, heterogeneous varved).

5.2.8 Summary of Soil Classification

In summary, soils shall be classified in a similar manner by each geologist/engineer at a project site. The hierarchy of classification is as follows:

- Density and/or consistency
- Color
- Plasticity (Optional)
- Soil types
- Moisture content
- Stratification
- Texture, fabric, bedding
- Other distinguishing features

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 10 of 20
	Revision 1	Effective Date 06/99

FIGURE 3

BEDDING THICKNESS CLASSIFICATION

Thickness (metric)	Thickness (Approximate English Equivalent)	Classification
> 1.0 meter	> 3.3'	Massive
30 cm - 1 meter	1.0' - 3.3'	Thick Bedded
10 cm - 30 cm	4" - 1.0'	Medium Bedded
3 cm - 10 cm	1" - 4"	Thin Bedded
1 cm - 3 cm	2/5" - 1"	Very Thin Bedded
3 mm - 1 cm	1/8" - 2/5"	Laminated
1 mm - 3 mm	1/32" - 1/8"	Thinly Laminated
< 1 mm	<1/32"	Micro Laminated

(Weir, 1973 and Ingram, 1954)

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 11 of 20
	Revision 1	Effective Date 06/99

5.3 Classification of Rocks

Rocks are grouped into three main divisions: sedimentary, igneous and metamorphic. Sedimentary rocks are by far the predominant type exposed at the earth's surface. The following basic names are applied to the types of rocks found in sedimentary sequences:

- Sandstone - Made up predominantly of granular materials ranging between 1/16 to 2 mm in diameter.
- Siltstone - Made up of granular materials less than 1/16 to 1/256 mm in diameter. Fractures irregularly. Medium thick to thick bedded.
- Claystone - Very fine-grained rock made up of clay and silt-size materials. Fractures irregularly. Very smooth to touch. Generally has irregularly spaced pitting on surface of drilled cores.
- Shale - A fissile very fine-grained rock. Fractures along bedding planes.
- Limestone - Rock made up predominantly of calcite (CaCO_3). Effervesces strongly upon the application of dilute hydrochloric acid.
- Coal - Rock consisting mainly of organic remains.
- Others - Numerous other sedimentary rock types are present in lesser amounts in the stratigraphic record. The local abundance of any of these rock types is dependent upon the depositional history of the area. Conglomerate, halite, gypsum, dolomite, anhydrite, lignite, etc. are some of the rock types found in lesser amounts.

In classifying a sedimentary rock the following hierarchy shall be noted:

- Rock type
- Color
- Bedding thickness
- Hardness
- Fracturing
- Weathering
- Other characteristics

5.3.1 **Rock Type**

As described above, there are numerous types of sedimentary rocks. In most cases, a rock will be a combination of several grain types, therefore, a modifier such as a sandy siltstone, or a silty sandstone can be used. The modifier indicates that a significant portion of the rock type is composed of the modifier. Other modifiers can include carbonaceous, calcareous, siliceous, etc.

Grain size is the basis for the classification of clastic sedimentary rocks. Figure 4 is the Udden-Wentworth classification that will be assigned to sedimentary rocks. The individual boundaries are slightly different than the USCS subdivision for soil classification. For field determination of grain sizes, a scale can be used for the coarse grained rocks. For example, the division between siltstone and claystone may not be measurable in the field. The boundary shall be determined by use of a hand lens. If the grains cannot be seen with the naked eye but are distinguishable with a hand lens, the rock is a siltstone. If the grains are not distinguishable with a hand lens, the rock is a claystone.

FIGURE 4**GRAIN SIZE CLASSIFICATION FOR ROCKS**

Particle Name	Grain Size Diameter
Cobbles	> 64 mm
Pebbles	4 - 64 mm
Granules	2 - 4 mm
Very Coarse Sand	1 - 2 mm
Coarse Sand	0.5 - 1 mm
Medium Sand	0.25 - 0.5 mm
Fine Sand	0.125 - 0.25 mm
Very Fine Sand	0.0625 - 0.125 mm
Silt	0.0039 - 0.0625 mm

After Wentworth, 1922

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 13 of 20
	Revision 1	Effective Date 06/99

5.3.2 Color

The color of a rock can be determined in a similar manner as for soil samples. Rock core samples shall be classified while wet, when possible, and air cored samples shall be scraped clean of cuttings prior to color classifications.

Rock color charts shall not be used unless specified by the Project Manager.

5.3.3 Bedding Thickness

The bedding thickness designations applied to soil classification (see Figure 3) will also be used for rock classification.

5.3.4 Hardness

The hardness of a rock is a function of the compaction, cementation, and mineralogical composition of the rock. A relative scale for sedimentary rock hardness is as follows:

- Soft - Weathered, considerable erosion of core, easily gouged by screwdriver, scratched by fingernail. Soft rock crushes or deforms under pressure of a pressed hammer. This term is always used for the hardness of the saprolite (decomposed rock which occupies the zone between the lowest soil horizon and firm bedrock).
- Medium soft - Slight erosion of core, slightly gouged by screwdriver, or breaks with crumbly edges from single hammer blow.
- Medium hard - No core erosion, easily scratched by screwdriver, or breaks with sharp edges from single hammer blow.
- Hard - Requires several hammer blows to break and has sharp conchoidal breaks. Cannot be scratched with screwdriver.

Note the difference in usage here of the words "scratch" and "gouge." A scratch shall be considered a slight depression in the rock (do not mistake the scraping off of rock flour from drilling with a scratch in the rock itself), while a gouge is much deeper.

5.3.5 Fracturing

The degree of fracturing or brokenness of a rock is described by measuring the fractures or joint spacing. After eliminating drilling breaks, the average spacing is calculated and the fracturing is described by the following terms:

- Very broken (V. BR.) - Less than 2-inch spacing between fractures
- Broken (BR.) - 2-inch to 1-foot spacing between fractures
- Blocky (BL.) - 1- to 3-foot spacing between fractures
- Massive (M.) - 3 to 10-foot spacing between fractures

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 14 of 20
	Revision 1	Effective Date 06/99

The structural integrity of the rock can be approximated by calculating the Rock Quality Designation (RQD) of cores recovered. The RQD is determined by adding the total lengths of all pieces exceeding 4 inches and dividing by the total length of the coring run, to obtain a percentage.

Method of Calculating RQD
(After Deere, 1964)

$$RQD \% = r/l \times 100$$

r = Total length of all pieces of the lithologic unit being measured, which are greater than 4 inches length, and have resulted from natural breaks. Natural breaks include slickensides, joints, compaction slicks, bedding plane partings (not caused by drilling), friable zones, etc.

l = Total length of the coring run.

5.3.6 Weathering

The degree of weathering is a significant parameter that is important in determining weathering profiles and is also useful in engineering designs. The following terms can be applied to distinguish the degree of weathering:

- Fresh - Rock shows little or no weathering effect. Fractures or joints have little or no staining and rock has a bright appearance.
- Slight - Rock has some staining which may penetrate several centimeters into the rock. Clay filling of joints may occur. Feldspar grains may show some alteration.
- Moderate - Most of the rock, with exception of quartz grains, is stained. Rock is weakened due to weathering and can be easily broken with hammer.
- Severe - All rock including quartz grains is stained. Some of the rock is weathered to the extent of becoming a soil. Rock is very weak.

5.3.7 Other Characteristics

The following items shall be included in the rock description:

- Description of contact between two rock units. These can be sharp or gradational.
- Stratification (parallel, cross stratified).
- Description of any filled cavities or vugs.
- Cementation (calcareous, siliceous, hematitic).
- Description of any joints or open fractures.
- Observation of the presence of fossils.
- Notation of joints with depth, approximate angle to horizontal, any mineral filling or coating, and degree of weathering.

All information shown on the boring logs shall be neat to the point where it can be reproduced on a copy machine for report presentation. The data shall be kept current to provide control of the drilling program and to indicate various areas requiring special consideration and sampling.

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 15 of 20
	Revision 1	Effective Date 06/99

5.3.8 Additional Terms Used in the Description of Rock

The following terms are used to further identify rocks:

- Seam - Thin (12 inches or less), probably continuous layer.
- Some - Indicates significant (15 to 40 percent) amounts of the accessory material. For example, rock composed of seams of sandstone (70 percent) and shale (30 percent) would be "sandstone -- some shale seams."
- Few - Indicates insignificant (0 to 15 percent) amounts of the accessory material. For example, rock composed of seam of sandstone (90 percent) and shale (10 percent) would be "sandstone -- few shale seams."
- Interbedded - Used to indicate thin or very thin alternating seams of material occurring in approximately equal amounts. For example, rock composed of thin alternating seams of sandstone (50 percent) and shale (50 percent) would be "interbedded sandstone and shale."
- Interlayered - Used to indicate thick alternating seams of material occurring in approximately equal amounts.

The preceding sections describe the classification of sedimentary rocks. The following are some basic names that are applied to igneous rocks:

- Basalt - A fine-grained extrusive rock composed primarily of calcic plagioclase and pyroxene.
- Rhyolite - A fine-grained volcanic rock containing abundant quartz and orthoclase. The fine-grained equivalent of a granite.
- Granite - A coarse-grained plutonic rock consisting essentially of alkali feldspar and quartz.
- Diorite - A coarse-grained plutonic rock consisting essentially of sodic plagioclase and hornblende.
- Gabbro - A coarse-grained plutonic rock consisting of calcic plagioclase and clinopyroxene. Loosely used for any coarse-grained dark igneous rock.

The following are some basic names that are applied to metamorphic rocks:

- Slate - A very fine-grained foliated rock possessing a well developed slaty cleavage. Contains predominantly chlorite, mica, quartz, and sericite.
- Phyllite - A fine-grained foliated rock that splits into thin flaky sheets with a silky sheen on cleavage surface.
- Schist - A medium to coarse-grained foliated rock with subparallel arrangement of the micaceous minerals which dominate its composition.
- Gneiss - A coarse-grained foliated rock with bands rich in granular and platy minerals.
- Quartzite - A fine- to coarse-grained nonfoliated rock breaking across grains, consisting essentially of quartz sand with silica cement.

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 16 of 20
	Revision 1	Effective Date 06/99

5.4 Abbreviations

Abbreviations may be used in the description of a rock or soil. However, they shall be kept at a minimum. Following are some of the abbreviations that may be used:

C - Coarse	Lt - Light	Yl - Yellow
Med - Medium	BR - Broken	Or - Orange
F - Fine	BL - Blocky	SS - Sandstone
V - Very	M - Massive	Sh - Shale
Sl - Slight	Br - Brown	LS - Limestone
Occ - Occasional	Bl - Black	Fgr - Fine-grained
Tr - Trace		

5.5 Boring Logs and Documentation

This section describes in more detail the procedures to be used in completing boring logs in the field. Information obtained from the preceding sections shall be used to complete the logs. A sample boring log has been provided as Figure 5.

The field geologist/engineer shall use this example as a guide in completing each boring log. Each boring log shall be fully described by the geologist/engineer as the boring is being drilled. Every sheet contains space for 25 feet of log. Information regarding classification details is provided either on the back of the boring log or on a separate sheet, for field use.

5.5.1 Soil Classification

- Identify site name, boring number, job number, etc. Elevations and water level data to be entered when surveyed data is available.
- Enter sample number (from SPT) under appropriate column. Enter depth sample was taken from (1 block = 1 foot). Fractional footages, i.e., change of lithology at 13.7 feet, shall be lined off at the proportional location between the 13- and 14-foot marks. Enter blow counts (Standard Penetration Resistance) diagonally (as shown). Standard penetration resistance is covered in Section 5.2.3.
- Determine sample recovery/sample length as shown. Measure the total length of sample recovered from the split-spoon sampler, including material in the drive shoe. Do not include cuttings or wash material that may be in the upper portion of the sample tube.
- Indicate any change in lithology by drawing a line at the appropriate depth. For example, if clayey silt was encountered from 0 to 5.5 feet and shale from 5.5 to 6.0 feet, a line shall be drawn at this increment. This information is helpful in the construction of cross-sections. As an alternative, symbols may be used to identify each change in lithology.
- The density of granular soils is obtained by adding the number of blows for the last two increments. Refer to Density of Granular Soils Chart on back of log sheet. For consistency of cohesive soils refer also to the back of log sheet - Consistency of Cohesive Soils. Enter this information under the appropriate column. Refer to Section 5.2.3.

Subject

BOREHOLE AND SAMPLE LOGGING

Number

GH-1.5

Page

17 of 20

Revision

1

Effective Date

06/99

FIGURE 5
COMPLETED BORING LOG (EXAMPLE)

**BORING LOG**Page 1 of 1

PROJECT NAME:
PROJECT NUMBER:
DRILLING COMPANY:
DRILLING RIG:

NSB- SITE

9594

SOILTEST CO.

CME-55

BORING NUMBER: SB/MW1

DATE:

3/8/96

GEOLOGIST:

SJ CONTI

DRILLER:

R. ROCK

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	U S C S *	Remarks	PID/FID Reading (ppm)			
										Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 e 0800	0.0 2.0	7 6 10	1.5/2.0		M DENSE	BRN TO BLK	SILTY SAND - SOME ROCK FR. TR BRICKS (FILL)	SM	MOIST SL. ORG. ODOR FILL TO 4'±	5	0	0	0
S-2 e 0810	4.0 6.0	5 7 8	2.9/2.0	4.0	M DENSE	BRN	SILTY SAND - TR FINE GRAVEL	SM	MOIST - W ODOR NAT. MATL. TOOK SAMPLE SB01-0406 FOR ANALYSIS	10	0	-	-
S-3 e 0820	8.0 10.0	6 8 16	1.9/2.0	8.0	DENSE	TAN BRN	FINE TO COARSE SAND TR.F. GRAVEL	SW	WET HIT WATER @ 7'±	0	0	0	0
S-4 e 0830	12.0 14.0	7 6 8	1.6/2.0	12.0	STIFF	GRAY	SILTY CLAY	CL	MOIST → WET	0	5	-	-
9/5 ①	15.0 16.0	4.0/5.0		15.0 16.0	M HARD	BRN	SILTSTONE	VER	WEATHERED LO *JNTS @ 15.5 WATER STAINS @ 16.5, 17.1, 17.5	0	0	0	0
4.9/5.0 ②	19.0 20.0	5.0/5.0		19.0 20.0	HARD	GRAY	SANDSTONE - SOME SILTSTONE	BR	LOSING SOME DRILL H ₂ O @ 17'± SET TEMP 6" CAS TO 15.5	0	0	0	0
	25.0			25.0					SET 2"Ø PVC SCREEN 16-25 SAND 14-25 PELLETS 12-14	0	0	0	0

* When rock coring, enter rock brokenness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: CME-55 RIG, 4 1/4" ID HSA - 9" OD ±

2" SPLIT SPOONS - 140 LB HAMMER - 30" DROP

NIX CORE IN BEDROCK RUN ① = 25 min, RUN ② = 15 min

Converted to Well:

Yes

No

Well I.D. #:

MW-1

Drilling Area

Background (ppm):

0

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 18 of 20
	Revision 1	Effective Date 06/99

- Enter color of the material in the appropriate column.
- Describe material using the USCS. Limit this column for sample description only. The predominant material is described last. If the primary soil is silt but has fines (clay) - use clayey silt. Limit soil descriptors to the following:
 - Trace: 0 - 10 percent
 - Some: 11 - 30 percent
 - And/Or: 31 - 50 percent
- Also indicate under Material Classification if the material is fill or natural soils. Indicate roots, organic material, etc.
- Enter USCS symbol - use chart on back of boring log as a guide. If the soils fall into one of two basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example ML/CL or SM/SP.
- The following information shall be entered under the "Remarks" column and shall include, but is not limited by, the following:
 - Moisture - estimate moisture content using the following terms - dry, moist, wet and saturated. These terms are determined by the individual. Whatever method is used to determine moisture, be consistent throughout the log.
 - Angularity - describe angularity of coarse grained particles using the terms angular, subangular, subrounded, or rounded. Refer to ASTM D 2488 or Earth Manual for criteria for these terms.
 - Particle shape - flat, elongated, or flat and elongated.
 - Maximum particle size or dimension.
 - Water level observations.
 - Reaction with HCl - none, weak, or strong.
- Additional comments:
 - Indicate presence of mica, caving of hole, when water was encountered, difficulty in drilling, loss or gain of water.
 - Indicate odor and Photoionization Detector (PID) or Flame Ionization Detector (FID) reading if applicable.
 - Indicate any change in lithology by drawing a line through the lithology change column and indicate the depth. This will help when cross-sections are subsequently constructed.
 - At the bottom of the page indicate type of rig, drilling method, hammer size and drop, and any other useful information (i.e., borehole size, casing set, changes in drilling method).

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 19 of 20
	Revision 1	Effective Date 06/99

- Vertical lines shall be drawn (as shown in Figure 5) in columns 6 to 8 from the bottom of each sample to the top of the next sample to indicate consistency of material from sample to sample, if the material is consistent. Horizontal lines shall be drawn if there is a change in lithology, then vertical lines drawn to that point.
- Indicate screened interval of well, as needed, in the lithology column. Show top and bottom of screen. Other details of well construction are provided on the well construction forms.

5.5.2 Rock Classification

- Indicate depth at which coring began by drawing a line at the appropriate depth. Indicate core run depths by drawing coring run lines (as shown) under the first and fourth columns on the log sheet. Indicate RQD, core run number, RQD percent, and core recovery under the appropriate columns.
- Indicate lithology change by drawing a line at the appropriate depth as explained in Section 5.5.1.
- Rock hardness is entered under designated column using terms as described on the back of the log or as explained earlier in this section.
- Enter color as determined while the core sample is wet; if the sample is cored by air, the core shall be scraped clean prior to describing color.
- Enter rock type based on sedimentary, igneous or metamorphic. For sedimentary rocks use terms as described in Section 5.3. Again, be consistent in classification. Use modifiers and additional terms as needed. For igneous and metamorphic rock types use terms as described in Sections 5.3.8.
- Enter brokenness of rock or degree of fracturing under the appropriate column using symbols VBR, BR, BL, or M as explained in Section 5.3.5 and as noted on the back of the Boring Log.
- The following information shall be entered under the remarks column. Items shall include but are not limited to the following:
 - Indicate depths of joints, fractures and breaks and also approximate to horizontal angle (such as high, low), i.e., 70° angle from horizontal, high angle.
 - Indicate calcareous zones, description of any cavities or vugs.
 - Indicate any loss or gain of drill water.
 - Indicate drop of drill tools or change in color of drill water.
- Remarks at the bottom of Boring Log shall include:
 - Type and size of core obtained.
 - Depth casing was set.
 - Type of rig used.
- As a final check the boring log shall include the following:
 - Vertical lines shall be drawn as explained for soil classification to indicate consistency of bedrock material.
 - If applicable, indicate screened interval in the lithology column. Show top and bottom of screen. Other details of well construction are provided on the well construction forms.

Subject BOREHOLE AND SAMPLE LOGGING	Number GH-1.5	Page 20 of 20
	Revision 1	Effective Date 06/99

5.5.3 Classification of Soil and Rock from Drill Cuttings

The previous sections describe procedures for classifying soil and rock samples when cores are obtained. However, some drilling methods (air/mud rotary) may require classification and borehole logging based on identifying drill cuttings removed from the borehole. Such cuttings provide only general information on subsurface lithology. Some procedures that shall be followed when logging cuttings are:

- Obtain cutting samples at approximately 5-foot intervals, sieve the cuttings (if mud rotary drilling) to obtain a cleaner sample, place the sample into a small sample bottle or "zip lock" bag for future reference, and label the jar or bag (i.e. hole number, depth, date, etc.). Cuttings shall be closely examined to determine general lithology.
- Note any change in color of drilling fluid or cuttings, to estimate changes in lithology.
- Note drop or chattering of drilling tools or a change in the rate of drilling, to determine fracture locations or lithologic changes.
- Observe loss or gain of drilling fluids or air (if air rotary methods are used), to identify potential fracture zones.
- Record this and any other useful information onto the boring log as provided in Figure 1.

This logging provides a general description of subsurface lithology and adequate information can be obtained through careful observation of the drilling process. It is recommended that split-barrel and rock core sampling methods be used at selected boring locations during the field investigation to provide detailed information to supplement the less detailed data generated through borings drilled using air/mud rotary methods.

5.6 Review

Upon completion of the borings logs, copies shall be made and reviewed. Items to be reviewed include:

- Checking for consistency of all logs.
- Checking for conformance to the guideline.
- Checking to see that all information is entered in their respective columns and spaces.

6.0 REFERENCES

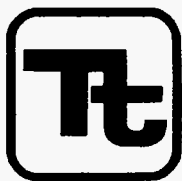
Unified Soil Classification System (USCS).

ASTM D2488, 1985.

Earth Manual, U.S. Department of the Interior, 1974.

7.0 RECORDS

Originals of the boring logs shall be retained in the project files.



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number	HS-1.0	Page	1 of 15
Effective Date	12/03	Revision	2
Applicability	Tetra Tech NUS, Inc.		
Prepared	Health & Safety		
Approved	D. Senovich		

Subject
UTILITY LOCATING AND EXCAVATION CLEARANCE

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE	2
2.0 SCOPE	2
3.0 GLOSSARY	2
4.0 RESPONSIBILITIES	3
5.0 PROCEDURES	3
5.1 BURIED UTILITIES	3
5.2 OVERHEAD POWER LINES	5
6.0 UNDERGROUND LOCATING TECHNIQUES	5
6.1 GEOPHYSICAL METHODS	5
6.2 PASSIVE DETECTION SURVEYS	6
6.3 INTRUSIVE DETECTION SURVEYS	6
7.0 INTRUSIVE ACTIVITIES SUMMARY	7
8.0 REFERENCES	8

ATTACHMENTS

1	Listing of Underground Utility Clearance Resources	9
2	Frost Line Penetration Depths by Geographic Location	11
3	Utility Clearance Form	12
4	OSHA Letter of Interpretation	13

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 2 of 15
	Revision 2	Effective Date 12/03

1.0 PURPOSE

Utilities such as electric service lines, natural or propane gas lines, water and sewage lines, telecommunications, and steam lines are very often in the immediate vicinity of work locations. Contact with underground or overhead utilities can have serious consequences including employee injury/fatality, property and equipment damage, substantial financial impacts, and loss of utility service to users.

The purpose of this procedure is to provide minimum requirements and technical guidelines regarding the appropriate procedures to be followed when performing subsurface and overhead utility locating services. It is the policy of Tetra Tech NUS, Inc. (TtNUS) to provide a safe and healthful work environment for the protection of our employees. The purpose of this Standard Operating Procedure (SOP) is to aid in achieving the objectives of this policy, to present the acceptable procedures pertaining to utility locating and excavation clearance activities, and to present requirements and restrictions relevant to these types of activities. This SOP must be reviewed by any employee potentially involved with underground or overhead utility locating and avoidance activities.

2.0 SCOPE

This procedure applies to all TtNUS field activities where there may be potential contact with underground or overhead utilities. This procedure provides a description of the principles of operation, instrumentation, applicability, and implementability of typical methods used to determine the presence and avoidance of contact with utility services. This procedure is intended to assist with work planning and scheduling, resource planning, field implementation, and subcontractor procurement. Utility locating and excavation clearance requires site-specific information prior to the initiation of any such activities on a specific project. This SOP is not intended to provide a detailed description of methodology and instrument operation. Specialized expertise during both planning and execution of several of the methods presented may also be required.

3.0 GLOSSARY

Electromagnetic Induction (EMI) Survey - A geophysical exploration method whereby electromagnetic fields are induced in the ground and the resultant secondary electromagnetic fields are detected as a measure of ground conductivity.

Magnetometer – A device used for precise and sensitive measurements of magnetic fields.

Magnetic Survey – A geophysical survey method that depends on detection of magnetic anomalies caused by the presence of buried ferromagnetic objects.

Metal Detection – A geophysical survey method that is based on electromagnetic coupling caused by underground conductive objects.

Vertical Gradiometer – A magnetometer equipped with two sensors that are vertically separated by a fixed distance. It is best suited to map near surface features and is less susceptible to deep geologic features.

Ground Penetrating Radar – Ground Penetrating Radar (GPR) involves specialized radar equipment whereby a signal is sent into the ground via a transmitter. Some portion of the signal will be reflected from the subsurface material, which is then recorded with a receiver and electronically converted into a graphic picture.

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 3 of 15
	Revision 2	Effective Date 12/03

4.0 RESPONSIBILITIES

Project Manager (PM)/Task Order Manager (TOM) - Responsible for ensuring that all field activities are conducted in accordance with this procedure.

Site Manager (SM)/Field Operations Leader (FOL) - Responsible for the onsite verification that all field activities are performed in compliance with approved SOPs or as otherwise directed by the approved project plan(s).

Site Health & Safety Officer (SHSO) – Responsible to provide technical assistance and verify full compliance with this SOP. The SHSO is also responsible for reporting any deficiencies to the Corporate Health and Safety Manager (HSM) and to the PM/TOM.

Health & Safety Manager (HSM) – Responsible for preparing, implementing, and modifying corporate health and safety policy and this SOP.

Site Personnel – Responsible for performing their work activities in accordance with this SOP and the TtNUS Health and Safety Policy.

5.0 PROCEDURES

This procedure addresses the requirements and technical procedures that must be performed to minimize the potential for contact with underground and overhead utility services. These procedures are addressed individually from a buried and overhead standpoint.

5.1 Buried Utilities

Buried utilities present a heightened concern because their location is not typically obvious by visual observation, and it is common that their presence and/or location is unknown or incorrectly known on client properties. This procedure must be followed prior to beginning any subsurface probing or excavation that might potentially be in the vicinity of underground utility services. In addition, the Utility Clearance Form (Attachment 3) must be completed for every location or cluster of locations where intrusive activities will occur.

Where the positive identification and de-energizing of underground utilities cannot be obtained and confirmed using the following steps, the PM/TOM is responsible for arranging for the procurement of a qualified, experienced, utility locating subcontractor who will accomplish the utility location and demarcation duties specified herein.

1. A comprehensive review must be made of any available property maps, blue lines, or as-builts prior to site activities. Interviews with local personnel familiar with the area should be performed to provide additional information concerning the location of potential underground utilities. Information regarding utility locations shall be added to project maps upon completion of this exercise.
- 2., A visual site inspection must be performed to compare the site plan information to actual field conditions. Any findings must be documented and the site plan/maps revised. The area(s) of proposed excavation or other subsurface activities must be marked at the site in white paint or pin flags to identify those locations of the proposed intrusive activities. The site inspection should focus on locating surface indications of potential underground utilities. Items of interest include the presence of nearby area lights, telephone service, drainage grates, fire hydrants, electrical service vaults/panels, asphalt/concrete scars and patches, and topographical depressions. Note the location of any emergency shut off switches. Any additional information regarding utility

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 4 of 15
	Revision 2	Effective Date 12/03

locations shall be added to project maps upon completion of this exercise and returned to the PM/TOM.

3. If the planned work is to be conducted on private property (e.g., military installations, manufacturing facilities, etc.) the FOL must identify and contact appropriate facility personnel (e.g., public works or facility engineering) before any intrusive work begins to inquire about (and comply with) property owner requirements. It is important to note that private property owners may require several days to several weeks advance notice prior to locating utilities.
4. If the work location is on public property, the state agency that performs utility clearances must be notified (see Attachment 1). State "one-call" services must be notified prior to commencing fieldwork per their requirements. Most one-call services require, by law, 48- to 72-hour advance notice prior to beginning any excavation. Such services typically assign a "ticket" number to the particular site. This ticket number must be recorded for future reference and is valid for a specific period of time, but may be extended by contacting the service again. The utility service will notify utility representatives who then mark their respective lines within the specified time frame. It should be noted that most military installations own their own utilities but may lease service and maintenance from area providers. Given this situation, "one call" systems may still be required to provide location services on military installations.
5. Utilities must be identified and their locations plainly marked using pin flags, spray paint, or other accepted means. The location of all utilities must be noted on a field sketch for future inclusion on project maps. Utility locations are to be identified using the following industry-standard color code scheme, unless the property owner or utility locator service uses a different color code:

white	excavation/subsurface investigation location
red	electrical
yellow	gas, oil, steam
orange	telephone, communications
blue	water, irrigation, slurry
green	sewer, drain
6. Where utility locations are not confirmed with a high degree of confidence through drawings, schematics, location services, etc., the work area must be thoroughly investigated prior to beginning the excavation. In these situations, utilities must be identified using safe and effective methods such as passive and intrusive surveys, or the use of non-conductive hand tools. Also, in situations where such hand tools are used, they should always be used in conjunction with suitable detection equipment, such as the items described in Section 6.0 of this SOP. Each method has advantages and disadvantages including complexity, applicability, and price. It also should be noted that in some states, initial excavation is required by hand to a specified depth.
7. At each location where trenching or excavating will occur using a backhoe or other heavy equipment, and where utility identifications and locations cannot be confirmed prior to groundbreaking, the soil must be probed using a device such as a tile probe which is made of non-conductive material such as fiberglass. If these efforts are not successful in clearing the excavation area of suspect utilities, hand shoveling must be performed for the perimeter of the intended excavation.
8. All utilities uncovered or undermined during excavation must be structurally supported to prevent potential damage. Unless necessary as an emergency corrective measure, TtNUS shall not make any repairs or modifications to existing utility lines without prior permission of the utility owner, property owner, and Corporate HSM. All repairs require that the line be locked-out/tagged-out prior to work.

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 5 of 15
	Revision 2	Effective Date 12/03

5.2 Overhead Power Lines

If it is necessary to work within the minimum clearance distance of an overhead power line, the overhead line must be de-energized and grounded, or re-routed by the utility company or a registered electrician. If protective measures such as guarding, isolating, or insulating are provided, these precautions must be adequate to prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

The following table provides the required minimum clearances for working in proximity to overhead power lines.

<u>Nominal Voltage</u>	<u>Minimum Clearance</u>
0 -50 kV	10 feet, or one mast length; whichever is greater
50+ kV	10 feet plus 4 inches for every 10 kV over 50 kV or 1.5 mast lengths; whichever is greater

6.0 UNDERGROUND LOCATING TECHNIQUES

A variety of supplemental utility locating approaches are available and can be applied when additional assurance is needed. The selection of the appropriate method(s) to employ is site-specific and should be tailored to the anticipated conditions, site and project constraints, and personnel capabilities.

6.1 Geophysical Methods

Geophysical methods include electromagnetic induction, magnetics, and ground penetrating radar. Additional details concerning the design and implementation of electromagnetic induction, magnetics, and ground penetrating radar surveys can be found in one or more of the TtNUS SOPs included in the References (Section 8.0).

Electromagnetic Induction

Electromagnetic Induction (EMI) line locators operate either by locating a background signal or by locating a signal introduced into the utility line using a transmitter. A utility line acts like a radio antenna, producing electrons, which can be picked up with a radiofrequency receiver. Electrical current carrying conductors have a 60HZ signal associated with them. This signal occurs in all power lines regardless of voltage. Utilities in close proximity to power lines or used as grounds may also have a 60HZ signal, which can be picked up with an EM receiver. A typical example of this type of geophysical equipment is an EM-61.

EMI locators specifically designed for utility locating use a special signal that is either indirectly induced onto a utility line by placing the transmitter above the line or directly induced using an induction clamp. The clamp induces a signal on the specific utility and is the preferred method of tracing since there is little chance of the resulting signals being interfered with. A good example of this type of equipment is the Schonstedt® MAC-51B locator. The MAC-51B performs inductively traced surveys, simple magnetic locating, and traced nonmetallic surveys.

When access can be gained inside a conduit to be traced, a flexible insulated trace wire can be used. This is very useful for non-metallic conduits but is limited by the availability of gaining access inside the pipe.

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 6 of 15
	Revision 2	Effective Date 12/03

Magnetics

Magnetic locators operate by detecting the relative amounts of buried ferrous metal. They are incapable of locating or identifying nonferrous utility lines but can be very useful for locating underground storage tanks (UST's), steel utility lines, and buried electrical lines. A typical example of this type of equipment is the Schonstedt® GA-52Cx locator. The GA-52Cx is capable of locating 4-inch steel pipe up to 8 feet deep.

Non-ferrous lines are often located by using a typical plumbing tool (snake) fed through the line. A signal is then introduced to the snake that is then traced.

Ground Penetrating Radar

Ground Penetrating Radar (GPR) involves specialized radar equipment whereby a signal is sent into the ground via a transmitter. Some portion of the signal will be reflected from the subsurface material, which is then recorded with a receiver and electronically converted into a graphic picture. In general, an object which is harder than the surrounding soil will reflect a stronger signal. Utilities, tunnels, UST's, and footings will reflect a stronger signal than the surrounding soil. Although this surface detection method may determine the location of a utility, this method does not specifically identify utilities (i.e., water vs. gas, electrical vs. telephone); hence, verification may be necessary using other methods. This method is somewhat limited when used in areas with clay soil types or with a high water table.

6.2 Passive Detection Surveys

Acoustic Surveys

Acoustic location methods are generally most applicable to waterlines or gas lines. A highly sensitive Acoustic Receiver listens for background sounds of water flowing (at joints, leaks, etc.) or to sounds introduced into the water main using a transducer. Acoustics may also be applicable to determine the location of plastic gas lines.

Thermal Imaging

Thermal (i.e., infrared) imaging is a passive method for detecting the heat emitted by an object. Electronics in the infrared camera convert subtle heat differentials into a visual image on the viewfinder or a monitor. The operator does not look for an exact temperature; rather they look for heat anomalies (either elevated or suppressed temperatures) characteristic of a potential utility line.

The thermal fingerprint of underground utilities results from differences in temperature between the atmosphere and the fluid present in a pipe or the heat generated by electrical resistance. In addition, infrared scanners may be capable of detecting differences in the compaction, temperature and moisture content of underground utility trenches. High-performance thermal imagery can detect temperature differences to hundredths of a degree.

6.3 Intrusive Detection Surveys

Vacuum Excavation

Vacuum excavation is used to physically expose utility services. The process involves removing the surface material over approximately a 1' x 1' area at the site location. The air-vacuum process proceeds with the simultaneous action of compressed air-jets to loosen soil and vacuum extraction of the resulting

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 7 of 15
	Revision 2	Effective Date 12/03

debris. This process ensures the integrity of the utility line during the excavation process, as no hammers, blades, or heavy mechanical equipment comes into contact with the utility line, eliminating the risk of damage to utilities. The process continues until the utility is uncovered. Vacuum excavation can be used at the proposed site location to excavate below the "utility window" which is usually 8 feet.

Hand Excavation

When the identification and location of underground utilities cannot be positively confirmed through document reviews and/or other methods, borings and excavations may be cleared via the use of non-conductive hand tools. This should always be done in conjunction with the use of detection equipment. This would be required for all locations where there is a potential to impact buried utilities. The minimum hand-excavation depth that must be reached is to be determined considering the geographical location of the work site. This approach recognizes that the placement of buried utilities is influenced by frost line depths that vary by geographical region. Attachment 2 presents frost line depths for the regions of the contiguous United States. At a minimum, hand excavation depths must be at least to the frost line depth (see Attachment 2) plus two (2) feet, but never less than 4 feet below ground surface (bgs). For hand excavation, the hole created must be reamed large enough to be at least the diameter of the drill rig auger or bit prior to drilling. For soil gas surveys, the survey probe shall be placed as close as possible to the cleared hand excavation. It is important to note that a post-hole digger must not be used in this type of hand excavation activity.

Tile Probe Surveys

For some soil types, site conditions, and excavation requirements, non-conductive tile probes may be used. A tile probe is a "T"-handled rod of varying lengths that can be pushed into the soil to determine if any obstructions exist at that location. Tile probes constructed of fiberglass or other nonconductive material are readily-available from numerous vendors. Tile probes must be performed to the same depth requirements as previously specified. As with other types of hand excavating activities, the use of a non-conductive tile probe, should always be in conjunction with suitable utility locating detection equipment.

7.0 INTRUSIVE ACTIVITIES SUMMARY

The following list summarizes the activities that must be performed prior to beginning subsurface activities:

1. Map and mark all subsurface locations and excavation boundaries using white paint or markers specified by the client or property owner.
2. Notify the property owner and/or client that the locations are marked. At this point, drawings of locations or excavation boundaries shall be provided to the property owner and/or client so they may initiate (if applicable) utility clearance.

Note: Drawings with confirmed locations should be provided to the property owner and/or client as soon as possible to reduce potential time delays.

3. Notify "One Call" service. If possible, arrange for an appointment to show the One Call representative the surface locations or excavation boundaries in person. This will provide a better location designation to the utilities they represent. You should have additional drawings should you need to provide plot plans to the One Call service.
4. Implement supplemental utility detection techniques as necessary and appropriate to conform utility locations or the absence thereof.

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 8 of 15
	Revision 2	Effective Date 12/03

5. Complete Attachment 3, Utility Clearance Form. This form should be completed for each excavation location. In situations where multiple subsurface locations exist within the close proximity of one another, one form may be used for multiple locations provided those locations are noted on the Utility Clearance Form. Upon completion, the Utility Clearance Form and revised/annotated utility location map becomes part of the project file.

8.0 REFERENCES

OSHA Letter of Interpretation, Mr. Joseph Caldwell, Attachment 4
 OSHA 29 CFR 1926(b)(2)
 OSHA 29 CFR 1926(b)(3)
 TtNUS Utility Locating and Clearance Policy
 TtNUS SOP GH-3.1; Resistivity and Electromagnetic Induction
 TtNUS SOP GH-3.2; Magnetic and Metal Detection Surveys
 TtNUS SOP GH-3.4; Ground-penetrating Radar Surveys

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 9 of 15
	Revision 2	Effective Date 12/03

ATTACHMENT 1 **LISTING OF UNDERGROUND UTILITY CLEARANCE RESOURCES**



American Public Works Association
2345 Grand Boulevard, Suite 500, Kansas City, MO 64108-2625
Phone (816) 472-6100 • Fax (816) 472-1610
Web www.apwa.net • E-mail apwa@apwa.net

ONE-CALL SYSTEMS INTERNATIONAL CONDENSED DIRECTORY

Alabama
Alabama One-Call
1-800-292-8525

Alaska
Locate Call Center of Alaska, Inc.
1-800-478-3121

Arizona
Arizona Blue Stake
1-800-782-5348

Arkansas
Arkansas One Call System, Inc.
1-800-482-8998

California
Underground Service Alert North
1-800-227-2600
Underground Service Alert of Southern
California
1-800-227-2600

Colorado
Utility Notification Center of Colorado
1-800-922-1987

Connecticut
Call Before You Dig
1-800-922-4455

Delaware
Miss Utility of Delmarva
1-800-282-8555

Florida
Sunshine State One-Call of Florida, Inc.
1-800-432-4770

Georgia
Underground Protection Center, Inc.
1-800-282-7411

Hawaii
Underground Service Alert North
1-800-227-2600

Idaho
Dig Line Inc.
1-800-342-1585
Kootenai County One-Call
1-800-428-4950
Shoshone - Benewah One-Call
1-800-398-3285

Illinois
JULIE, Inc.
1-800-892-0123
Digger (Chicago Utility Alert Network)
312-744-7000

Indiana
Indiana Underground Plant Protection
Service
1-800-382-5544

Iowa
Iowa One-Call
1-800-292-8989

Kansas
Kansas One-Call System, Inc.
1-800-344-7233

Kentucky
Kentucky Underground Protection Inc.
1-800-752-6007

Louisiana
Louisiana One Call System, Inc.
1-800-272-3020

Maine
Dig Safe System, Inc.
1-888-344-7233

Maryland
Miss Utility
1-800-257-7777
Miss Utility of Delmarva
1-800-282-8555

Massachusetts
Dig Safe System, Inc.
1-888-344-7233

Michigan
Miss Dig System, Inc.
1-800-482-7171

Minnesota
Gopher State One Call
1-800-252-1168

Mississippi
Mississippi One-Call System, Inc.
1-800-227-6477

Missouri
Missouri One-Call System, Inc.
1-800-344-7483

Montana
Utilities Underground Protection Center
1-800-424-5555
Montana One Call Center
1-800-551-8344

Nebraska
Diggers Hotline of Nebraska
1-800-331-5666

Nevada
Underground Service Alert North
1-800-227-2600

New Hampshire
Dig Safe System, Inc.
1-888-344-7233

New Jersey
New Jersey One Call
1-800-272-1000

New Mexico
New Mexico One Call System, Inc.
1-800-321-2537
Las Cruces- Dona Ana Blue Stakes
1-888-526-0400

New York
Dig Safely New York
1-800-862-7962
New York City- Long Island One Call
Center
1-800-272-4480

North Carolina
The North Carolina One-Call Center,
Inc.
1-800-632-4949

North Dakota
North Dakota One-Call
1-800-795-0555

Ohio
Ohio Utilities Protection Service
1-800-362-2764
Oil & Gas Producers Underground
Protect'n Svc
1-800-925-0988

Oklahoma
Call Okie
1-800-522-6543

Oregon
Oregon Utility Notification Center/One
Call Concepts
1-800-332-2344

Pennsylvania
Pennsylvania One Call System, Inc.
1-800-242-1776

Rhode Island
Dig Safe System, Inc.
1-888-344-7233

South Carolina
Palmetto Utility Protection Service Inc.
1-888-721-7877

South Dakota
South Dakota One Call
1-800-781-7474

Tennessee
Tennessee One-Call System, Inc.
1-800-351-1111

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 10 of 15
	Revision 2	Effective Date 12/03

ATTACHMENT 1 (Continued)

Texas

Texas One Call System
1-800-245-4545
Texas Excavation Safety System, Inc.
1-800-344-8377
Lone Star Notification Center
1-800-669-8344

Utah

Blue Stakes of Utah
1-800-662-4111

Vermont

Dig Safe System, Inc.
1-888-344-7233

Virginia

Miss Utility of Virginia
1-800-552-7001
Miss Utility (Northern Virginia)
1-800-257-7777

Washington

Utilities Underground Location Center
1-800-424-5555
Northwest Utility Notification Center
1-800-553-4344
Inland Empire Utility Coordinating
Council
509-456-8000

West Virginia

Miss Utility of West Virginia, Inc.
1-800-245-4848

Wisconsin

Diggers Hotline, Inc.
1-800-242-8511

Wyoming

Wyoming One-Call System, Inc.
1-800-348-1030
Call Before You Dig of Wyoming
1-800-849-2476

District of Columbia

Miss Utility
1-800-257-7777

Alberta

Alberta One-Call Corporation
1-800-242-3447

British Columbia

BC One Call
1-800-474-6886

Ontario

Ontario One-Call System
1-800-400-2255

Quebec

Info-Excavation
1-800-663-9228

Subject

UTILITY LOCATING AND
EXCAVATION CLEARANCE

Number

HS-1.0

Revision

2

Page

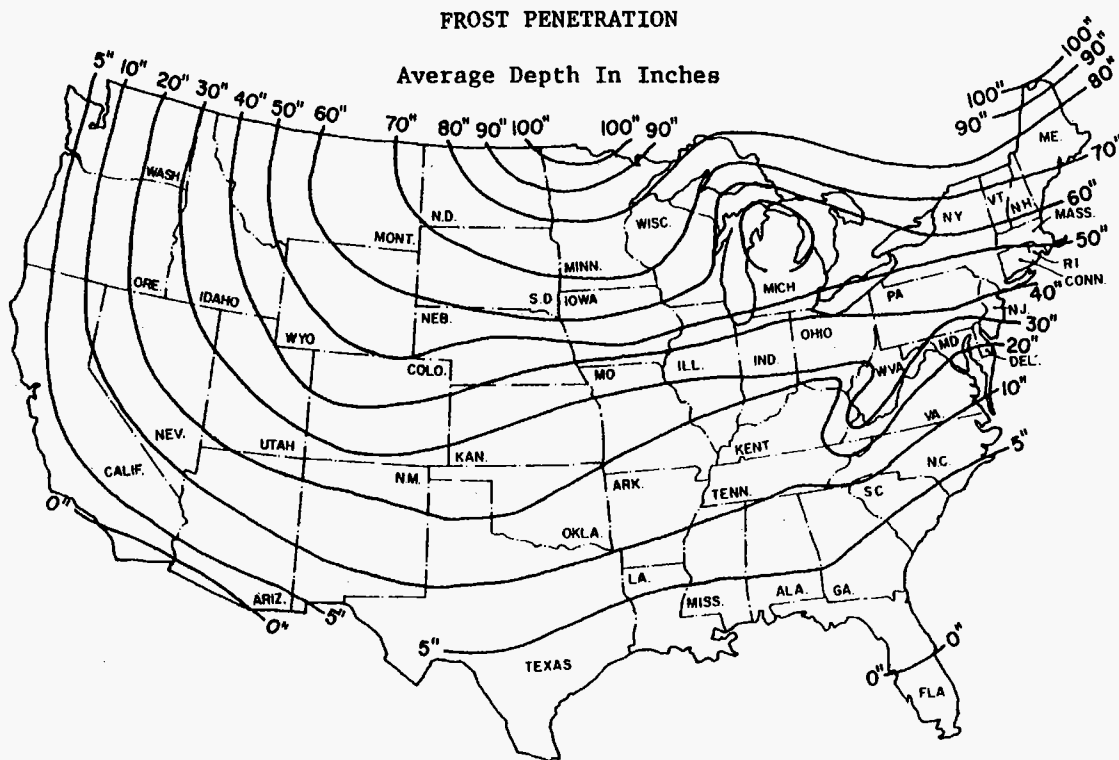
11 of 15

Effective Date

12/03

ATTACHMENT 2

FROST LINE PENETRATION DEPTHS BY GEOGRAPHIC LOCATION



Courtesy U.S. Department Of Commerce

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 12 of 15
	Revision 2	Effective Date 12/03

**ATTACHMENT 3
UTILITY CLEARANCE FORM**

Client: _____ Project Name: _____
 Project No.: _____ Completed By: _____
 Location Name: _____ Work Date: _____
 Excavation Method/Overhead Equipment: _____

1. Underground Utilities Circle One
- a) Review of existing maps? yes no N/A
- b) Interview local personnel? yes no N/A
- c) Site visit and inspection? yes no N/A
- d) Excavation areas marked in the field? yes no N/A
- e) Utilities located in the field? yes no N/A
- f) Located utilities marked/added to site maps? yes no N/A
- g) Client contact notified yes no N/A
 Name _____ Telephone: _____ Date: _____
- g) State One-Call agency called? yes no N/A
 Caller: _____
 Ticket Number: _____ Date: _____
- h) Geophysical survey performed? yes no N/A
 Survey performed by: _____
 Method: _____ Date: _____
- i) Hand excavation performed (with concurrent use of utility yes no N/A
 detection device)?
 Completed by: _____
 Total depth: _____ feet Date: _____
- j) Trench/excavation probed? yes no N/A
 Probing completed by: _____
 Depth/frequency: _____ Date: _____
2. Overhead Utilities Present Absent
- a) Determination of nominal voltage yes no N/A
- b) Marked on site maps yes no N/A
- c) Necessary to lockout/insulate/re-route yes no N/A
- d) Document procedures used to lockout/insulate/re-route yes no N/A
- e) Minimum acceptable clearance (SOP Section 5.2): _____

3. Notes: _____

Approval:

 Site Manager/Field Operations Leader

 Date

c: PM/Project File
 Program File

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 13 of 15
	Revision 2	Effective Date 12/03

ATTACHMENT 4 OSHA LETTER OF INTERPRETATION

Mr. Joseph Caldwell
Consultant
Governmental Liaison
Pipeline Safety Regulations
211 Wilson Boulevard
Suite 700
Arlington, Virginia 22201

Re: Use of hydro-vacuum or non-conductive hand tools to locate underground utilities.

Dear Mr. Caldwell:

In a letter dated July 7, 2003, we responded to your inquiry of September 18, 2002, regarding the use of hydro-vacuum equipment to locate underground utilities by excavation. After our letter to you was posted on the OSHA website, we received numerous inquiries that make it apparent that aspects of our July 7 letter are being misunderstood. In addition, a number of industry stakeholders, including the National Utility Contractors Association (NUCA), have provided new information regarding equipment that is available for this work.

To clarify these issues, we are withdrawing our July 7 letter and issuing this replacement response to your inquiry.

***Question:** Section 1926.651 contains several requirements that relate to the safety of employees engaged in excavation work. Specifically, paragraphs (b)(2) and (b)(3) relate in part to the safety of the means used to locate underground utility installations that, if damaged during an uncovering operation, could pose serious hazards to employees.*

Under these provisions, what constitutes an acceptable method of uncovering underground utility lines, and further, would the use of hydro-vacuum excavation be acceptable under the standard?

Answer

Background

Two sections of 29 CFR 1926 Subpart P (Excavations), 1926.651(Specific excavation requirements), govern methods for uncovering underground utility installations. Specifically, paragraph (b)(2) states:

When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours * * * or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used. (emphasis added).

Paragraph (b)(3) provides:

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 14 of 15
	Revision 2	Effective Date 12/03

ATTACHMENT 4 (Continued)

When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means. (emphasis added).

Therefore, “acceptable means” must be used where the location of the underground utilities have not been identified by the utility companies and detection equipment is not used.

Subpart P does not contain a definition of either “other acceptable means” or “safe and acceptable means.” The preambles to both the proposed rule and the final rule discussed the rationale behind the wording at issue. For example, the preamble to the proposed rule, 52 Fed. Reg. 12301 (April 15, 1987), noted that a 1972 version of this standard contained language that specified “careful probing or hand digging” as the means to uncover utilities. The preamble then noted that an amendment to the 1972 standard later deleted that language “to allow other, *equally effective means* of locating such installations.” The preamble continued that in the 1987 proposed rule, OSHA again proposed using language in section (b)(3) that would provide another example of an acceptable method of uncovering utilities that could be used where the utilities have not been marked and detection equipment is not being used – “probing with hand-held tools.” This method was rejected in the final version of 29 CFR 1926. As OSHA explained in the preamble to the final rule, 54 Fed. Reg. 45916 (October 31, 1989):

OSHA received two comments * * * and input from ACCSH [OSHA’s Advisory Committee on Construction Safety and Health] * * * on this provision. All commenters recommended dropping ‘such as probing with hand-held tools’ from the proposed provision, because this could create a hazard to employees by damaging the installation or its insulation.

In other words, the commenters objected to the use of hand tools being used unless detection equipment was used in conjunction with them. OSHA then concluded its discussion relative to this provision by agreeing with the commentators and ultimately not including any examples of “acceptable means” in the final provision.

Non-conductive hand tools are permitted

This raises the question of whether the standard permits the use of hand tools alone -- without also using detection equipment. NUCA and other industry stakeholders have recently informed us that non-conductive hand tools that are appropriate to be used to locate underground utilities are now commonly available.

Such tools, such as a “shooter” (which has a non-conductive handle and a snub nose) and non-conductive or insulated probes were not discussed in the rulemaking. Since they were not considered at that time, they were not part of the class of equipment that was thought to be unsafe for this purpose. Therefore, we conclude that the use of these types of hand tools, when used with appropriate caution, is an “acceptable means” for locating underground utilities.

Subject UTILITY LOCATING AND EXCAVATION CLEARANCE	Number HS-1.0	Page 15 of 15
	Revision 2	Effective Date 12/03

ATTACHMENT 4 (Continued)

Hydro-vacuum excavation

It is our understanding that some hydro-vacuum excavation equipment can be adjusted to use a minimum amount of water and suction pressure. When appropriately adjusted so that the equipment will not damage underground utilities (especially utilities that are particularly vulnerable to damage, such as electrical lines), use of such equipment would be considered a "acceptable means" of locating underground utilities. However, if the equipment cannot be sufficiently adjusted, then this method would not be acceptable under the standard.

Other technologies

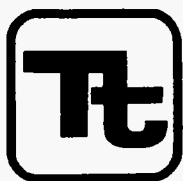
We are not suggesting that these are the only devices that would be "acceptable means" under the standard. Industry stakeholders have informed us that there are other types of special excavation equipment designed for safely locating utilities as well.

We apologize for any confusion our July 7 letter may have caused. If you have further concerns or questions, please feel free to contact us again by fax at: U.S. Department of Labor, OSHA, Directorate of Construction, Office of Construction Standards and Compliance Assistance, fax # 202-693-1689. You can also contact us by mail at the above office, Room N3468, 200 Constitution Avenue, N.W., Washington, D.C. 20210, although there will be a delay in our receiving correspondence by mail.

Sincerely,

Russell B. Swanson, Director
Directorate of Construction

NOTE: OSHA requirements are set by statute, standards and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at <http://www.osha.gov>.



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number	SA-2.5	Page	1 of 6
Effective Date	09/03	Revision	3
Applicability	Tetra Tech NUS, Inc.		
Prepared	Earth Sciences Department		
Approved	D. Senovich <i>DS</i>		

Subject DIRECT PUSH TECHNOLOGY
(GEOPROBE®/HYDROPUNCH™)

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE	2
2.0 SCOPE	2
3.0 GLOSSARY	2
4.0 RESPONSIBILITIES	2
5.0 SOIL SAMPLING PROCEDURES	3
5.1 GENERAL	3
5.2 SAMPLING EQUIPMENT	3
5.3 DPT SAMPLING METHODOLOGY	3
6.0 GROUNDWATER SAMPLING PROCEDURES	4
6.1 GENERAL	4
6.2 SAMPLING EQUIPMENT	4
6.3 DPT TEMPORARY WELL POINT INSTALLATION AND SAMPLING METHODOLOGY	5
7.0 RECORDS	5
 <u>ATTACHMENTS</u>	
1 SAFE WORK PERMIT	6

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 2 of 6
	Revision 3	Effective Date 09/03

1.0 PURPOSE

The purpose of this procedure is to provide general reference information on Direct Push Technology (DPT). DPT is designed to collect soil, groundwater, and soil gas samples without using conventional drilling techniques. The advantage of using DPT over conventional drilling includes the generation of little or no drill cuttings, sampling in locations with difficult accessibility, reduced overhead clearance requirements, no fluid introduction during probing, and typical lower costs per sample than with conventional techniques. Disadvantages include a maximum penetration depth of approximately 15 to 40 feet in dense soils (although it may be as much as 60 to 80 feet in certain types of geological environments), reduced capability of obtaining accurate water-level measurements, and the inability to install permanent groundwater monitoring wells. The methods and equipment described herein are for collection of surface and subsurface soil samples and groundwater samples. Soil gas sampling is discussed in SOP SA-2.4.

2.0 SCOPE

This procedure provides information on proper sampling equipment and techniques for DPT. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described shall be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments in methodology.

3.0 GLOSSARY

Direct Push Technology (DPT) - DPT refers to sampling tools and sensors that are driven directly into the ground without the use of conventional drilling equipment. DPT typically utilizes hydraulic pressure and/or percussion hammers to advance the sampling tools. A primary advantage of DPT over conventional drilling techniques is that DPT results in the generation of little or no investigation derived waste.

Geoprobe® - Geoprobe® is a manufacturer of a hydraulically-powered, percussion/probing machines utilizing DPT to collect subsurface environmental samples. Geoprobe® relies on a relatively small amount of static weight (vehicle) combined with percussion as the energy for advancement of a tool string. The Geoprobe® equipment can be mounted in a multitude of vehicles for access to all types of environmental sites.

HydroPunch™ - HydroPunch™ is a manufacturer of stainless steel and Teflon® sampling tools that are capable of collecting representative groundwater and/or soil samples without requiring the installation of a groundwater monitoring well or conventional soil boring. HydroPunch™ is an example of DPT sampling equipment.

Flame Ionization Detector (FID) - A portable instrument for the measurement of many combustible organic compounds and a few inorganic compounds in air at parts-per million levels. The basis for the detection is the ionization of gaseous species utilizing a flame as the energizing source.

Photo Ionization Detector (PID) - A portable instrument for the measurement of many combustible organic compounds and a few inorganic compounds in air at parts-per million levels. The basis for the detection is the ionization of gaseous species utilizing ultraviolet radiation as the energizing source.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for selecting and/or reviewing the appropriate DPT drilling procedure required to support the project objectives.

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 3 of 6
	Revision 3	Effective Date 09/03

Field Operations Leader (FOL)- The FOL is primarily responsible for performing the DPT in accordance with the project-specific plan.

5.0 SOIL SAMPLING PROCEDURES

5.1 General

The common methodology for the investigation of the vadose zone is soil boring drilling and soil sampling. However, drilling soil borings can be very expensive. Generally the advantage of DPT for subsurface soil sampling is the reduced cost of disposal of drilling cuttings and shorter sampling times.

5.2 Sampling Equipment

Equipment needed for conducting DPT drilling for subsurface soil sampling includes, but is not limited to, the following:

- Geoprobe® Sampling Kit
- Cut-resistant gloves
- 4-foot x 1.5-inch diameter macrocore sampler
- Probe sampling adapters
- Roto-hammer with 1.5-inch bit
- Disposable acetate liners for soil macrocore sampler
- Cast aluminum or steel drive points
- Geoprobe® AT-660 Series Large Bore Soil Sampler, or equivalent
- Standard decontamination equipment and solutions

For health and safety equipment and procedures, follow the direction provided in the Safe Work Permit in Attachment 1, or the more detailed directions provided in the project's Health and Safety Plan.

5.3 DPT Sampling Methodology

There are several methods for the collection of soil samples using DPT drilling. The most common method is discussed in the following section. Variations of the following method may be conducted upon approval of the Project Manager in accordance with the project-specific plan.

- Macrocore samplers fitted with detachable aluminum or steel drive points are driven into the ground using hydraulic pressure. If there is concrete or pavement over a sampling location, a Roto-hammer is used to drill a minimum 1.5-inch diameter hole through the surface material. A Roto-hammer may also be used if very dense soils are encountered.
- The sampler is advanced continuously in 4-foot intervals or less if desired. No soil cuttings are generated because the soil which is not collected in the sampler is displaced within the formation.
- The sampler is retracted from the hole, and the 4-foot continuous sample is removed from the outer coring tube. The sample is contained within an inner acetate liner.
- Attach the metal trough from the Geoprobe® Sampling Kit firmly to the tail gate of a vehicle. If a vehicle with a tail gate is not available, secure the trough on another suitable surface.
- Place the acetate liner containing the soils in the trough.

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 4 of 6
	Revision 3	Effective Date 09/03

- While wearing cut-resistant gloves (constructed of leather or other suitable material), cut the acetate liner through its entire length using the double-bladed knife that accompanies the Geoprobe® Sampling Kit. Then remove the strip of acetate from the trough to gain access to the collected soils. Do not attempt to cut the acetate liner while holding it in your hand.
- Field screen the sample with an FID or PID, and observe/examine the sample (according to SOP GH-1.3). If appropriate, transfer the sample to sample bottles for laboratory analysis. If additional volume is required, push an additional boring adjacent to the first and composite/mix the same interval. Field compositing is usually not acceptable for sample requiring volatile organics analysis.
- Once sampling has been completed, the hole is backfilled with bentonite chips or bentonite cement grout, depending upon project requirements. Asphalt or concrete patch is used to cap holes through paved or concrete areas. All holes should be finished smooth to existing grade.
- In the event the direct push van/truck cannot be driven to a remote location or a sampling location with difficult accessibility, sampling probes may be advanced and sampled manually or with air/electric operated equipment (e.g., jack hammer).
- Sampling equipment is decontaminated prior to collecting the next sample.

6.0 GROUNDWATER SAMPLING PROCEDURES

6.1 General

The most common methodology for the investigation of groundwater is the installation and sampling of permanent monitoring wells. If only groundwater screening is required, the installation and sampling of temporary well points may be performed. The advantage of temporary well point installation using DPT is reduced cost due to no or minimal disposal of drilling cuttings and well construction materials, and shorter installation/times sampling.

Two disadvantages of DPT drilling for well point installation are:

- In aquifers with low yields, well points may have to be sampled without purging or development.
- If volume requirements are high, this method can be time consuming for low yield aquifers.

6.2 Sampling Equipment

Equipment needed for temporary well installation and sampling using DPT includes, but is not limited, to the following:

- 2-foot x 1-inch diameter mill-slotted (0.005 to 0.02-inch) well point
- Connecting rods
- Roto-hammer with 1.5-inch bit
- Mechanical jack
- 1/4-inch OD polyethylene tubing
- 3/8-inch OD polyethylene tubing
- Peristaltic pump
- Standard decontamination equipment and solutions

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 5 of 6
	Revision 3	Effective Date 09/03

6.3 DPT Temporary Well Point Installation and Sampling Methodology

There are several methods for the installation and sampling of temporary well points using DPT. The most common methodology is discussed below. Variations of the following method may be conducted upon approval of the Project Manager in accordance with the project specific plan.

- A 2-foot x 1-inch diameter mill-slotted (0.005 to 0.02-inch) well point attached to connecting rods is driven into the ground to the desired depth using a rotary electric hammer or other direct push drill rig. If there is concrete or pavement over a sampling location, a Roto-hammer or electric coring machine is used to drill a hole through the surface material.
- The well point will be allowed to equilibrate for at least 15 minutes, after which a measurement of the static water level will be taken. The initial measurement of the water level will be used to assess the amount of water which is present in the well point and to determine the amount of silt and sand infiltration that may have occurred.
- The well point will be developed using a peristaltic pump and polyethylene tubing to remove silt and sand which may have entered the well point. The well point is developed by inserting polyethylene tubing to the bottom of the well point and lifting and lowering the tubing slightly while the pump is operating. The pump will be operated at a maximum rate of approximately 2 liters per minute. After removal of sediment from the bottom of the well point, the well point will be vigorously pumped at maximum capacity until discharge water is visibly clear and no further sediments are being generated. Measurements of pH, specific conductance, temperature, and turbidity shall be recorded every 5 to 10 minutes during the purging process. After two consistent readings of pH, specific conductance, temperature and turbidity (± 10 percent), the well may be sampled.
- A sample will be collected using the peristaltic pump set at the same or reduced speed as during well development. Samples (with the exception of the samples to be analyzed for volatile organic compounds, VOCs) will be collected directly from the pump discharge. Sample containers for VOCs will be filled by (first shutting off the pump) crimping the discharge end of the sample tubing when filled, removing the inlet end of the sample tubing from the well, suspending the inlet tubing above the vial, and allowing water to fill each vial by gravity flow.
- Once the groundwater sample has been collected, the connecting rods and well point will be removed from the hole with the direct push rig hydraulics. The hole will be backfilled with bentonite chips or bentonite cement grout, depending upon project requirements. Asphalt or concrete patch will be used to cap holes through paved or concrete areas. All holes will be finished smooth to existing grade.
- In the event the direct push van/truck cannot be driven to a remote location or sampling location with difficult accessibility, sampling probes may be advanced and sampled manually or with air/electric-operated equipment (e.g., jack hammer).
- Decontaminate the equipment before moving to the next location.

7.0 RECORDS

A record of all field procedures, tests, and observations must be recorded in the field logbook, boring logs, and sample log sheets, as needed. Entries should include all pertinent data regarding the investigation. The use of sketches and field landmarks will help to supplement the investigation and evaluation.

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 6 of 6
	Revision 3	Effective Date 09/03

**ATTACHMENT 1
SAFE WORK PERMIT FOR DPT OPERATIONS**

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

- I. Work limited to the following (description, area, equipment used): **Monitoring well drilling and installation through direct push technology**
- II. Required Monitoring Instruments: _____
- III. Field Crew: _____
- IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

- V. Protective equipment required Respiratory equipment required
- | | | |
|--|--|--|
| Level D <input checked="" type="checkbox"/> Level B <input type="checkbox"/> | Full face APR <input type="checkbox"/> | Escape Pack <input type="checkbox"/> |
| Level C <input type="checkbox"/> Level A <input type="checkbox"/> | Half face APR <input type="checkbox"/> | SCBA <input type="checkbox"/> |
| Detailed on Reverse | SKA-PAC SAR <input type="checkbox"/> | Bottle Trailer <input type="checkbox"/> |
| | Skid Rig <input type="checkbox"/> | None <input checked="" type="checkbox"/> |

Level D Minimum Requirements: Sleeved shirt and long pants, safety footwear, and work gloves. Safety glasses, hard hats, and hearing protection will be worn when working near or sampling in the vicinity of the DPT rig.

Modifications/Exceptions.

- | VI. Chemicals of Concern | Action Level(s) | Response Measures |
|--------------------------|-----------------|-------------------|
| _____ | _____ | _____ |

VII. Additional Safety Equipment/Procedures

- | | |
|---|--|
| Hard-hat <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | Hearing Protection (Plugs/Muffs) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Safety Glasses <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | Safety belt/harness <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Chemical/splash goggles <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | Radio <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Splash Shield <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | Barricades <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Splash suits/coveralls <input type="checkbox"/> Yes <input type="checkbox"/> No | Gloves (Type - _____) <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Steel toe Work shoes or boots <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | Work/warming regimen <input type="checkbox"/> Yes <input type="checkbox"/> No |

Modifications/Exceptions: Reflective vests for high traffic areas.

- | | | | | |
|--|-------------------------------------|-------------------------------------|--------------------------|--------------------------|
| VIII. Procedure review with permit acceptors | Yes | NA | Yes | NA |
| Safety shower/eyewash (Location & Use)..... | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Daily tail gate meetings..... | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Contractor tools/equipment/PPE inspected | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Emergency alarms | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Evacuation routes | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Assembly points | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

IX. Site Preparation

- | | |
|---|--|
| Utility Clearances obtained for areas of subsurface investigation | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Physical hazards removed or blockaded | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Site control boundaries demarcated/signage | <input type="checkbox"/> Yes <input type="checkbox"/> No |

X. Equipment Preparation

- | | |
|--|---|
| Equipment drained/depressurized..... | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Equipment purged/cleaned..... | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Isolation checklist completed..... | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Electrical lockout required/field switch tested | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Blinds/misalignments/blocks & bleeds in place | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Hazardous materials on walls/behind liners considered..... | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |


- XI. Additional Permits required (Hot work, confined space entry). ☐ Yes ☐ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

- XII. Special instructions, precautions:
- _____
- _____

Permit Issued by: _____ Permit Accepted by: _____



STANDARD OPERATING PROCEDURES

Number	SA-1.3	Page	1 of 31
Effective Date	04/072008	Revision	9
Applicability	Tetra Tech NUS, Inc.		
Prepared	Earth Sciences Department		
Approved	 Tom Johnston		

Subject
SOIL SAMPLING

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE.....	2
2.0 SCOPE.....	2
3.0 GLOSSARY	2
4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS	3
5.0 HEALTH AND SAFETY	4
6.0 PROCEDURES.....	5
6.1 Overview	6
6.2 Soil Sample Collection.....	6
6.2.1 Procedure for Preserving and Collecting Soil Samples for Volatile Organic Compound Analysis	6
6.2.2 Procedure for Collecting Soil Samples for Non-Volatile Analyses	9
6.2.3 Procedure for Collecting Undisturbed Soil Samples	10
6.3 Surface Soil Sampling	13
6.4 Near-Surface Soil Sampling	14
6.5 Subsurface Soil Sampling With a Hand Auger.....	15
6.6 Subsurface Soil Sampling with a Split-Barrel Sampler.....	17
6.7 Subsurface Soil Sampling Using Direct-Push Technology	18
6.8 Excavation and Sampling of Test Pits and Trenches.....	18
6.8.1 Applicability	18
6.8.2 Test Pit and Trench Excavation.....	19
6.8.3 Sampling in Test Pits and Trenches.....	21
6.8.4 Backfilling of Trenches and Test Pits	25
6.9 Records.....	25
7.0 REFERENCES.....	26
<u>ATTACHMENTS</u>	
A SOIL & SEDIMENT SAMPLE LOG SHEET.....	28
B SPLIT-SPOON SAMPLER	29
C TEST PIT LOG.....	30
D REMOTE SAMPLE HOLDER FOR TEST PIT/TRENCH SAMPLING.....	31

Subject SOIL SAMPLING	Number SA-1.3	Page 2 of 31
	Revision 9	Effective Date 04/07/2008

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures to be used to collect surface, near-surface, and subsurface soil samples. Additionally, it describes the methods for sampling of test pits and trenches to determine subsurface soil and rock conditions and for recovery of small-volume or bulk samples from pits.

2.0 SCOPE

This document applies to the collection of surface, near-surface, and subsurface soil samples exposed through hand digging, hand augering, drilling, or machine excavating at hazardous substance sites for laboratory testing, onsite visual examination, and onsite testing.

3.0 GLOSSARY

Composite Sample - A composite sample is a combination of more than one grab sample from various locations and/or depths and times that is homogenized and treated as one sample. This type of sample is usually collected when determination of an average waste concentration for a specific area is required. Composite samples shall not be collected for volatile organics analysis.

Confined Space - As stipulated in 29 Code of Federal Regulations (CFR) 1910.146, a confined space means a space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work; (2) has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, pits, and excavations); and (3) is not designed for continuous employee occupancy. TtNUS considers all confined space as permit-required confined spaces.

Grab Sample - One sample collected at one location and at one specific time.

Hand Auger - A sampling device used to extract soil from the ground.

Representativeness – A qualitative description of the degree to which an individual sample accurately reflects population characteristics or parameter variations at a sampling point. It is therefore an important characteristic not only of assessment and quantification of environmental threats posed by the site, but also for providing information for engineering design and construction. Proper sample location selection and proper sample collection methods are important to ensure that a truly representative sample has been collected.

Sample for Non-Volatile Analyses - Includes all chemical parameters other than volatile organics (e.g., semivolatiles, pesticides/PCBs, metals, etc.) and those engineering parameters that do not require undisturbed soil for their analysis.

Split-Barrel Sampler - A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. Also called a split-spoon sampler, this device can be driven into resistant materials using a drive weight mounted in the drilling string. A standard split-barrel sampler is typically available in two common lengths, providing either 20-inch or 26-inch longitudinal clearance for obtaining 18-inch or 24-inch-long samples, respectively. These split-barrel samplers commonly range in size from 2 to 3.5 inches OD. The larger sizes are commonly used when a larger volume of sample material is required (see Attachment B).

Test Pit and Trench - Open, shallow excavations, typically rectangular (if a test pit) or longitudinal (if a trench), excavated to determine shallow subsurface conditions for engineering, geological, and soil chemistry exploration and/or sampling purposes. These pits are excavated manually or by machine (e.g., backhoe, clamshell, trencher, excavator, or bulldozer).

Subject SOIL SAMPLING	Number SA-1.3	Page 3 of 31
	Revision 9	Effective Date 04/07/2008

Thin-Walled Tube Sampler - A thin-walled metal tube (also called a Shelby tube) used to recover relatively undisturbed soil samples. These tubes are available in various sizes, ranging from 2 to 5 inches outside diameter (OD) and from 18 to 54 inches in length.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Project Manager - The Project Manager is responsible for determining the sampling objectives, selecting proposed sampling locations, and selecting field procedures used in the collection of soil samples. Additionally, in consultation with other project personnel (geologist, hydrogeologist, etc.), the Project Manager establishes the need for test pits or trenches and determines their approximate locations and dimensions.

Site Safety Officer (SSO) - The SSO (or a qualified designee) is responsible for providing the technical support necessary to implement the project Health and Safety Plan. This will include (but not be limited to) performing air quality monitoring during sampling, boring, and excavation activities and to ensure that workers and offsite (downwind) individuals are not exposed to hazardous levels of airborne contaminants. The SSO/designee may also be required to advise the FOL on other safety-related matters regarding boring, excavation, and sampling, such as mitigative measures to address potential hazards from unstable trench walls, puncturing of drums or other hazardous objects, etc.

Field Operations Leader (FOL) - This individual is primarily responsible for the execution of the planning document containing the Sampling and Analysis Plan (SAP). This is accomplished through management of a field sampling team for the proper acquisition of samples. He or she is responsible for the supervision of onsite analyses; ensuring proper instrument calibration, care, and maintenance; sample collection and handling; the completion and accuracy of all field documentation; and making sure that custody of all samples obtained is maintained according to proper procedures. When appropriate and as directed by the FOL, such responsibilities may be performed by other qualified personnel (e.g., field technicians) where credentials and time permit. The FOL is responsible for finalizing the locations for collection of surface, near-surface, and subsurface (hand and machine borings, test pits/trenches) soil samples. He/she is ultimately responsible for the sampling and backfilling of boreholes, test pits, and trenches and for adherence to Occupational Safety and Health Administration (OSHA) regulations during these operations through self acquisition or through the management of a field team of samplers.

Project Geologist/Sampler - The project geologist/sampler is responsible for the proper acquisition of samples in accordance with this SOP and/or other project-specific documents. In addition, this individual is responsible for the completion of all required paperwork (e.g., sample log sheets, field notebook, boring logs, test pit logs, container labels, custody seals, and chain-of-custody forms) associated with the collection of those samples.

Competent Person - A Competent Person, as defined in 29 CFR 1929.650 of Subpart P - Excavations, means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

General personnel qualifications for groundwater sample collection and onsite water quality testing include the following:

- Occupational Safety and Health Administration (OSHA) 40-hour and applicable refresher training.
- Capability of performing field work under the expected physical and environmental (i.e., weather) conditions.

Subject SOIL SAMPLING	Number SA-1.3	Page 4 of 31
	Revision 9	Effective Date 04/07/2008

- Familiarity with appropriate procedures for sample documentation, handling, packaging, and shipping.

5.0 HEALTH AND SAFETY

Health and safety precautions are identified for individual sample collection procedures throughout this SOP. In addition to those precautions, the following general hazards may be incurred during sampling activities:

- Knee injuries from kneeling on hard or uneven surfaces
- Slips, trips, and falls
- Cuts and lacerations
- Traffic hazards associated with sampling in parking areas, along roadways and highways.

Methods of avoiding these hazards are provided below.

Knee injuries – If kneeling is required during soil sampling, this could result in knee injuries from stones/foreign objects and general damage due to stress on the joints. To minimize this hazard:

- Clear any foreign objects from the work area.
- Wear hard-sided knee pads.
- Stretch ligaments, tendons and muscles before, during and after. Take breaks as frequently as necessary.
- Report pre-existing conditions to the SSO if you feel this activity will aggravate an existing condition.

Slips, Trips, and Falls – These hazards exist while traversing varying terrains carrying equipment to sample locations. To minimize these hazards:

- Pre-survey sampling locations. Eliminate, barricade, or otherwise mark physical hazards leading to the locations.
- Carry small loads that do not restrict the field of vision.
- Travel the safest and clearest route (not necessarily the shortest).

Cuts and Lacerations - To prevent cuts and lacerations associated with soil sampling, the following provisions are required:

- Always cut away from yourself and others when cutting tubing or rope. This will prevent injury to yourself and others if the knife slips.
- Do not place items to be cut in your hand or on your knee.
- Change blades as necessary to maintain a sharp cutting edge. Many accidents result from struggling with dull cutting attachments.

Subject SOIL SAMPLING	Number SA-1.3	Page 5 of 31
	Revision 9	Effective Date 04/07/2008

- Whenever practical, wear cut-resistant gloves (e.g., leather or heavy cotton work gloves) at least on the hand not using the knife.
- Keep cutting surfaces clean and smooth.
- Secure items to be cut – do not hold them against the opposing hand, a leg, or other body part.
- When transporting glassware, keep it in a hard-sided container such as a cooler so that if there is a fall, you will be less likely to get cut by broken glass.
- DO NOT throw broken sample jars or glass ampoules into garbage bags. Place broken glass and glass ampoules in hard-sided containers such as a cardboard box or directly into a dumpster. DO NOT reach into garbage bags to retrieve any item accidentally thrown away. Empty the contents onto a flat surface to avoid punctures and lacerations from reaching where you cannot see.

Vehicular and Foot Traffic Hazards – When sampling along the roadway or near traffic patterns, follow the following precautions:

- Motorists may be distracted by onsite activities – ASSUME THEY DO NOT SEE YOU OR MEMBERS OF YOUR FIELD CREW.
- DO NOT place obstructions (such as vehicles) along the sides of the road that may cause site personnel to move into the flow of traffic to avoid your activities or equipment or that will create a blind spot.
- **Provide a required free space of travel.** Maintain at least 6 feet of space between you and moving traffic. Where this is not possible, use flaggers and/or signs to warn oncoming traffic of activities near or within the travel lanes.
- Face Traffic. Whenever feasible, if you must move within the 6 feet of the required free space or into traffic, attempt to face moving traffic at all times. Always leave yourself an escape route.
- Wear high-visibility vests to increase visual recognition by motorists.
- Do not rely on the vehicle operator's visibility, judgment, or ability. Make eye contact with the driver. Carefully and deliberately use hand signals so they will not startle or confuse motorists or be mistaken for a flagger's direction before moving into traffic.
- Your movements may startle a motorist and cause an accident, so move deliberately. Do not make sudden movements that might confuse a motorist.

6.0 PROCEDURES

The following procedures address surface and subsurface sampling.

CAUTION

Each situation must be evaluated individually to determine the applicability and necessity for obtaining a utility clearance ticket/dig permit. Common sense dictates, prior to digging or boring with power equipment, no matter what the depth, or digging by hand in a manner that could damage unprotected underground utilities, that a dig permit is required. See SOP HS-1.0, Utility Locating and Excavation Clearance, for additional clarification. If you do not know or are unsure as to whether a ticket is necessary – **Get the Ticket.**

Subject SOIL SAMPLING	Number SA-1.3	Page 6 of 31
	Revision 9	Effective Date 04/07/2008

6.1 Overview

Soil sampling is an important adjunct to groundwater monitoring. Sampling of the soil horizons above the groundwater table can detect contaminants before they migrate to the water table, and can establish the amount of contamination absorbed or adsorbed on aquifer solids that have the potential of contributing to groundwater contamination.

Soil types can vary considerably on a hazardous waste site. These variations, along with vegetation, can affect the rate of contaminant migration through the soil. It is important, therefore, that a detailed record be maintained during sampling operations, particularly noting sampling locations, depths, and such characteristics as grain size, color, and odor. Subsurface conditions are often stable on a daily basis and may demonstrate only slight seasonal variation especially with respect to temperature, available oxygen and light penetration. Changes in any of these conditions can radically alter the rate of chemical reactions or the associated microbiological community, thus further altering specific site conditions. Certain vegetation species can create degradation products that can alter contaminant concentrations in soil. This is why vegetation types and extent of degradation of this foliage must be recorded. To prevent degradation, samples must be kept at their at-depth temperature or lower, protected from direct light, sealed tightly in approved glass containers, and be analyzed as soon as possible after collection. In addition, to the extent possible, vegetation should be removed from the sample.

The physical properties of the soil, its grain size, cohesiveness, associated moisture, and such factors as depth to bedrock and water table, will limit the depth from which samples can be collected and the method required to collect them. It is the intent of this document to present the most commonly employed soil sampling methods used at hazardous waste sites.

6.2 Soil Sample Collection

6.2.1 Procedure for Preserving and Collecting Soil Samples for Volatile Organic Compound Analysis

Samples collected using traditional methods such as collection in a jar with no preservation have been known to yield non-representative samples due to loss of volatile organic compounds (VOCs). To prevent such losses, preservation of samples with methanol or sodium bisulfate may be used to minimize volatilization and biodegradation. This preservation may be performed either in the field or laboratory, depending on the sampling methodology employed. Because of the large number of sampling methods and associated equipment required, careful coordination between field and laboratory personnel is needed.

Soil samples to be preserved by the laboratory are currently being collected using Method SW-846, 5035. For samples preserved in the field, laboratories are currently performing low-level analyses (sodium bisulfate preservation) and high- to medium-level analyses (methanol preservation) depending on the needs of the end user.

The following procedures outline the necessary steps for collecting soil samples to be preserved at the laboratory, and for collecting soil samples to be preserved in the field with methanol or sodium bisulfate.

6.2.1.1 Soil Samples to be Preserved at the Laboratory

Soil samples collected for volatile organic analysis that are to be preserved at the laboratory shall be obtained using a hermetically sealed sample vial such as an EnCore™ sampler. Each sample shall be

Subject SOIL SAMPLING	Number SA-1.3	Page 7 of 31
	Revision 9	Effective Date 04/07/2008

obtained using a reusable sampling handle (T-handle) that can be provided with the EnCore™ sampler when requested and purchased. Collect the sample in the following manner for each EnCore™ sampler:

1. Scene Safety - Evaluate the area where sampling will occur. Ensure that the area is safe from physical, chemical, and natural hazards. Clear or barricade those hazards that have been identified.
2. Wear the appropriate personal protective equipment (PPE). This will include, at a minimum, safety glasses and nitrile surgeon's gloves. If you must kneel on the ground or place equipment on the surface being sampled, cover the ground surface with plastic to minimize surface contamination of your equipment and clothing. Wear knee pads to protect your knees from kneeling on hard or uneven surfaces.
3. Load the Encore™ sampler into the T-handle with the plunger fully depressed.
4. Expose the area to be sampled using a hand trowel or similar device to remove surface debris.
5. Press the T-handle against the freshly exposed soil surface, forcing soil into the sampler. The plunger will be forced upward as the cavity fills with soil.
6. When the sampler is full, rotate the plunger and lock it into place. If the plunger does not lock, the sampler is not full. This method ensures there is no headspace. Soft soil may require several plunges or forcing soil against a hard surface such as a sample trowel to ensure that headspace is eliminated.
7. Use a paper towel to remove soil from the side of the sampler so a tight seal can be made between the sample cap and the rubber O-ring.
8. With soil slightly piled above the rim of the sampler, force the cap on until the catches hook the side of the sampler.
9. Remove any surface soil from the outside of the sampler and place in the foil bag provided with the sampler. Good work hygiene practices and diligent decontamination procedures prevents the spread of contamination even on the outside of the containers.
10. Label the bag with appropriate information in accordance with SOP SA-6.3.
11. Place the full sampler inside a lined cooler with ice and cool to 4°C ± 2 °C. Make sure any required trip blanks and temperature blanks are also in the cooler. Secure custody of the cooler in accordance with SOP SA-6.3.
12. Typically, collect three Encore™ samplers at each location. Consult the SAP or laboratory to determine the required number of Encore™ samplers to be collected.
13. The T-handle shall be decontaminated before moving to the next interval or location using a soap and water wash and rinse, and where applicable, the selected solvent as defined in the project planning documents.

Using this type of sampling device eliminates the need for field preservation and the shipping restrictions associated with preservatives. A complete set of instructions is included with each Encore™ sampler.

After the Encore™ samples are collected, they should be placed on ice immediately and delivered to the laboratory within 48 hours (following the chain-of-custody and documentation procedures outlined in SOP SA-6.1). Samples must be preserved by the laboratory within 48 hours of sample collection.

Subject SOIL SAMPLING	Number SA-1.3	Page 8 of 31
	Revision 9	Effective Date 04/07/2008

6.2.1.2 Soil Samples to be Preserved in the Field

Soil samples preserved in the field may be prepared for analyses using both the low-level (sodium bisulfate preservation) and high- to medium-level (methanol preservation) methods.

Safety Reminder

When using chemicals in the field to preserve samples, the FOL and/or SSO must ensure that Materials Safety Data Sheets (MSDSs) have been provided with the chemicals to be used. They also must ensure that these chemicals have been added to the Chemical Inventory List contained within Section 5.0, Hazard Communication, of your Health and Safety Guidance Manual (HSGM). Lastly, but most importantly, the FOL and/or SSO must review the hazards with personnel using these chemicals and ensure that provisions are available for recommended PPE and emergency measures (e.g., eyewash, etc.).

Methanol Preservation (High to Medium Level):

Bottles may be pre-spiked with methanol in the laboratory or prepared in the field. Soil samples to be preserved in the field with methanol shall utilize 40 to 60 mL glass vials with septum-lined lids. Each sample bottle shall be filled with 25 mL of demonstrated analyte-free purge-and-trap grade methanol. The preferred method for adding methanol to the sample bottle is by removing the lid and using a pipette or scaled syringe to add the methanol directly to the bottle.

CAUTION

NEVER attempt to pipette by mouth

In situations where personnel are required to spike the septum using a hypodermic needle, the following provisions for handling sharps must be in place:

- Training of personnel regarding methods for handling of sharps
- Hard-sided containers for the disposal of sharps
- Provisions for treatment in cases where persons have received a puncture wound

Soil shall be collected with the use of a decontaminated (or disposable), small-diameter coring device such as a disposable tube/plunger-type syringe with the tip cut off. The outside diameter of the coring device must be smaller than the inside diameter of the sample bottle neck.

A small electronic balance or manual scale will be necessary for measuring the volume of soil to be added to the methanol-preserved sample bottle. Calibration of the scale shall be performed prior to use and intermittently throughout the day according to the manufacturer's requirements.

The sample should be collected as follows:

1. Weigh the unused syringe and plunger to the nearest 0.01 gram.
2. Pull the plunger back and insert the syringe into the soil to be sampled.
3. Collect 8 to 12 grams of soil by pushing the syringe barrel into the soil.
4. Weigh the sample and adjust until obtaining the required amount of sample.

Subject SOIL SAMPLING	Number SA-1.3	Page 9 of 31
	Revision 9	Effective Date 04/07/2008

5. Record the sample weight to the nearest 0.01 gram in the field logbook and/or on the sample log sheet.
6. Extrude the weighed soil sample into the methanol-preserved sample bottle taking care not to contact the sample container with the syringe.
7. If dirty, wipe soil particles from the threads of the bottle and cap. Cap the bottle tightly.
8. After capping the bottle, swirl the sample (do not shake) in the methanol and break up the soil such that all of the soil is covered with methanol.
9. Place the sample on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

Sodium Bisulfate Preservation (Low Level):

CAUTION

Care should be taken when adding the soil to the sodium bisulfate solution. A chemical reaction of soil containing carbonates (limestone) may cause the sample to effervesce or the vial to possibly explode. To avoid this hazard or hazards of this type, a small sample aliquot should be subjected to the sample preservative. If it effervesces in an open air environment, utilize an alternative method such as Encore™ or 2-ounce jar.

Bottles may be prepared in the laboratory or in the field with sodium bisulfate solution. Samples to be preserved in the field using the sodium bisulfate method are to be prepared and collected as follows:

1. Add 1 gram of sodium bisulfate to 5 mL of laboratory-grade deionized water in a 40 to 60 mL glass vial with septum-lined lid.
2. Collect the soil sample and record the sample weight to the nearest 0.01 gram in the field logbook or on the sample log sheet as described for methanol preservation
3. Add the weighed sample to the sample vial.
4. Collect duplicate samples using the methanol preservation method on a one-for-one sample basis because it is necessary for the laboratory to perform both low-level and medium-level analyses.
5. Place the samples on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

NOTE

If lower detection limits are necessary, an option to field preserving with sodium bisulfate may be to collect EnCore™ samplers at a given sample location. Consult the planning documents to determine whether this is required. If it is, collect samples in accordance with the Encore™ sampling procedure above and then send all samplers to the laboratory to perform the required preservation and analyses.

6.2.2 Procedure for Collecting Soil Samples for Non-Volatile Analyses

Samples collected for non-volatile analyses may be collected as either grab or composite samples as follows:

Subject SOIL SAMPLING	Number SA-1.3	Page 10 of 31
	Revision 9	Effective Date 04/07/2008

1. With a stainless steel trowel or other approved tool, transfer a portion of soil to be sampled to a stainless steel bowl or disposable inert plastic tray.
2. Remove roots, vegetation, sticks, and stones larger than the size of a green pea.
3. Thoroughly mix the soil in the bowl or tray to obtain as uniform a texture and color as practicable. The soil type, moisture content, amount of vegetation, and other factors may affect the amount of time required to obtain a properly mixed sample. In some cases, it may be impossible to obtain a uniform sample appearance. Use the field logbook to describe any significant difficulties encountered in obtaining a uniform mixture.
4. Transfer the mixed soil to the appropriate sample containers and close the containers.
5. Label the sample containers in accordance with SOP SA-6.3.
6. Place the containers in a cooler of ice as soon after collection as possible.
7. Prepare the sample shipment and ship the samples in accordance with SOP SA-6.1.

NOTE

Cooling may not be required for some samples depending on the scheduled analyses. Consult the planning documents if in doubt regarding correct sample preservation conditions. When in doubt – Cool to 4° C.

NOTE

Head space is permitted in soil sample containers for non-volatile analyses to allow for sample expansion.

6.2.3 Procedure for Collecting Undisturbed Soil Samples

NOTE

Use of thin-walled undisturbed tube samplers is restricted by the consistency of the soil to be sampled. Often, very loose and/or wet samples cannot be retrieved by the samplers, and soil with a consistency in excess of very stiff cannot be penetrated by the sampler. Devices such as Dennison or Pitcher core samplers can be used to obtain undisturbed samples of stiff soil. Using these devices normally increases sampling costs, and therefore their use should be weighed against the need for acquiring an undisturbed sample. These devices are not discussed in this SOP because they are not commonly used.

When it is necessary to acquire undisturbed samples of soil for purposes of engineering parameter analysis (e.g., permeability), a thin-walled, seamless tube sampler (Shelby tube) shall be employed using the following collection procedure:

1. In preparation for sampling utilizing a drill rig, field personnel must complete the following activities:
 - Ensure that all subsurface drilling activities are preceded by a utility clearance for the area to be investigated. This includes activities described in SOP HS-1.0, Utility Location and Excavation Clearance, as well as any location-specific procedures that may apply.

Subject SOIL SAMPLING	Number SA-1.3	Page 11 of 31
	Revision 9	Effective Date 04/07/2008

REMEMBER

If you are digging near a marked utility (within the diameter of an underground utility that has been marked plus 18 inches), you must first locate the utility through vacuum extraction or hand digging to ensure that your activities will not damage the utility.

- Complete an Equipment Inspection Checklist for the drill rig or direct-push technology (DPT) rig. This checklist will be provided in the HASP.
 - Review the Safe Work Permit prior to conducting the activity.
 - Review the activity to be conducted.
2. Remove all surface debris (e.g., vegetation, roots, twigs, etc.) from the specific sampling location and drill and/or clean out the borehole to the desired sampling depth. Be careful to minimize potential disturbance of the material to be sampled. In saturated material, withdraw the drill bit slowly to prevent loosening of the soil around the borehole and to maintain the water level in the hole at or above groundwater level.

CAUTION

The use of bottom-discharge bits or jetting through an open-tube sampler to clean out the borehole shall not be allowed. Only the use of side-discharge bits is permitted.

3. Determine whether a stationary piston-type sampler is required to limit sample disturbance and aid in retaining the sample. Either the hydraulically operated or control rod activated-type of stationary piston sampler may be used.
4. Prior to inserting the tube sampler into the borehole, check to ensure that the sampler head contains a check valve. The check valve is necessary to keep water in the rods from pushing the sample out the tube sampler during sample withdrawal. In addition, the check valve maintains a positive suction within the tube to help retain the sample.
5. A stainless steel tube sampler is typically used to minimize chemical reaction between the sample and the sampling tube.
6. With the sampling tube resting on the bottom of the hole and the water level in the boring at groundwater level or above, push the tube into the soil with a continuous and rapid motion, without impacting or twisting. If the soil is too hard to penetrate by pushing alone, careful hammering may be used by minimizing drop distance (tapping) of the hammer. Before pulling the tube, turn it at least one revolution to shear the sample off at the bottom. In no case shall the tube be pushed farther than the length provided for the soil sample. Allow about 3 inches in the tube for cuttings and sludge.
7. Upon removal of the sampling tube from the hole, measure the length of sample in the tube and also the length penetrated.
8. Remove disturbed material in the upper end of the tube and measure the length of sample again.
9. After removing at least 1 inch of soil from the lower end, place enough packing material (clean inert material such as paper or cloth) tightly in each end of the Shelby tube and then pour melted wax into each end to make at least a ½-inch wax plug and then add more packing material to fill the voids at both ends.

Subject SOIL SAMPLING	Number SA-1.3	Page 12 of 31
	Revision 9	Effective Date 04/07/2008

10. Place plastic caps on the ends, tape the caps in place, and dip the ends in wax to prevent loss of soil.
11. Affix label(s) to the tube as required and record sample number, depth, penetration, and recovery length on the label.
12. Mark the "up" direction on the side and upper end of the tube with indelible ink.
13. Complete a chain-of-custody form (see SOP SA-6.3) and other required forms (including Attachment A of this SOP).
14. Ship samples protected with suitable resilient packing material to reduce shock, vibration, and disturbance.

CAUTION

To preserve sample integrity do not allow tubes to freeze, and store the samples vertically with the same orientation they had in the ground, (i.e., top of sample is up) in a cool place out of the sun at all times.

CAUTION

A primary concern in the preparation of the wax plugs is the potential for the heat source and melted wax to cause a fire and/or burns. Follow the directions below to prevent injury or fire.

Electrical Heating

Using hot plates to melt the wax is acceptable. In an outdoor setting, make sure a Ground Fault Circuit Interrupter (GFCI) is employed within the electrical circuit. If a portable generator is used, ensure that the generator is an adequate distance from the sampling operation (at least 50 feet). Ensure that the extension cord is rated for the intended load and for outdoor use and is free from recognizable damage. Ensure flammable preservatives are not employed or stored near the hot plate. Although a Hot Work Permit is not required, scene safety evaluation by site personnel of the above elements is. As always, if a fire potential exists, the provisions for extinguishing must be immediately accessible as well as any provisions for first aid measures.

Open Flame

If an open flame is used, the following provisions are necessary:

- Complete a Hot Work Permit and any local permit required for elevated temperature applications. The Hot Work Permit, provided in your HASP, will aid the FOL and/or the SSO in ensuring that fire protection provisions (extinguishers, fire watches, etc.) are in place as well as ensuring that local requirements have been addressed.
- Ensure that water is available to address any wax splashes or contact. If possible, immerse the contacted area. Where this is not possible, run water over the area and apply cold compresses. The need for medical attention or first aid shall be determined on site under the direction of the SSO.

Subject SOIL SAMPLING	Number SA-1.3	Page 13 of 31
	Revision 9	Effective Date 04/07/2008

6.3 **Surface Soil Sampling**

The simplest, most direct method of collecting surface soil samples for subsequent analysis is by use of a stainless steel shovel, hand auger, soil corer, or stainless steel or disposable plastic trowel.

NOTE

Multiple depth intervals are used to describe surface soil. Sometimes surface soil is defined as soil from 0 to 2 inches below ground surface (bgs), and sometimes it is defined as soil from other depths such as 0 to 2 feet bgs. Ensure that the definition of surface soil depth is clear before collecting surface soil samples.

For the purposes of instruction, the terms “surface soil” and “near-surface soil” are used in this SOP as follows:

- Surface soil - 0 to 6 inches bgs
- Near-surface soil - 6 to 18 inches bgs

If these intervals are defined differently in the planning documents, substitute the appropriate depth ranges.

In general, the following equipment is necessary for obtaining surface soil samples:

- Stainless steel or pre-cleaned disposable trowel.
- Stainless steel hand auger, soil corer, or shovel.
- Real-time air monitoring instrument (e.g., PID, FID) as directed in project planning document.
- Required PPE.
 - Nitrile surgeon's or latex gloves may be used, layered as necessary.
 - Safety glasses
 - Other – Items identified on the Safe Work Permit may be required based on location-specific requirements such as hearing protection, steel-toed work boots, and a hard hat when working near a drill rig. These provisions will be listed in the HASP or directed by the FOL and/or SSO.

Safety Reminder

The use of latex products may elicit an allergic reaction in some people. Should this occur, remove the latex gloves, treat for an allergic reaction, and seek medical attention as necessary.

- Required paperwork (see SOP SA-6.3 and Attachment A of this SOP)
- Required decontamination equipment
- Required sample container(s)
- Wooden stakes or pin flags

Subject SOIL SAMPLING	Number SA-1.3	Page 14 of 31
	Revision 9	Effective Date 04/07/2008

- Sealable polyethylene bags (e.g., Ziploc® baggies)
- Heavy duty cooler
- Ice
- Chain-of-custody records and custody seals

When acquiring surface soil samples, use the following procedure:

1. Place padding or use knee pads when kneeling near the sample location. If necessary, place plastic sheeting to provide a clean surface for sample equipment to avoid possible cross- contamination.
2. Carefully remove vegetation, roots, twigs, litter, etc. to expose an adequate soil surface area to accommodate sample volume requirements.
3. Using a precleaned syringe or EnCore™ samplers, follow the procedure in Section 6.2.1 for collecting surface soil samples for volatile analysis. Surface soil samples for volatile organic analysis should be collected deeper than 6 inches bgs because shallower material has usually lost most of the volatiles through evaporation. Ensure that the appropriate surface soil depth is being analyzed in accordance with the planning document.
4. Using decontaminated sampling tools, thoroughly mix in place a sufficient amount of soil to fill the remaining sample containers. See Section 6.5 of this procedure for hand auger instruction, as needed.
5. Transfer the sample into those containers utilizing a stainless steel trowel.
6. Cap and securely tighten all sample containers.
7. Affix a sample label to each container. Be sure to fill out each label carefully and clearly, addressing all the categories described in SOP SA-6.3.
8. Proceed with the handling and processing of each sample container as described in SOP SA-6.2.
9. Site restoration – Whenever removing sample materials, always restore the surface. It is our intent to leave the area better than we found it. Do NOT create trip hazards in areas when pedestrian traffic may exist.

6.4 Near-Surface Soil Sampling

Collection of samples from near the surface (depth of 6 to 18 inches) can be accomplished with tools such as shovels, hand auger, soil corers, and stainless steel or pre-cleaned disposable trowels and the equipment listed under Section 6.5 of this procedure.

To obtain near-surface soil samples, the following protocol shall be used:

1. With a clean shovel, make a series of vertical cuts in the soil to the depth required to form a square approximately 1 foot by 1 foot.
2. Lever out the formed plug and scrape the bottom of the freshly dug hole with a decontaminated stainless steel or pre-cleaned disposable trowel to remove any loose soil.

Subject SOIL SAMPLING	Number SA-1.3	Page 15 of 31
	Revision 9	Effective Date 04/07/2008

3. Follow steps 1 through 9 of Section 6.3.

6.5 Subsurface Soil Sampling With a Hand Auger

A hand augering system generally consists of a variety of stainless steel bucket bits (approximately 6.5 inches long and 2, 2.75, 3.25, and 4 inches in diameter), series of extension rods (available in 2-, 3-, 4- and 5-inch lengths), and a T-handle connected to extension rods and to the auger bucket. A larger-diameter bucket bit is commonly used to bore a hole to the desired sampling depth and then it is withdrawn. The larger-diameter bit is then replaced with a smaller-diameter bit, lowered down the hole, and slowly turned into the soil to the completion depth (approximately 6 inches). The apparatus is then withdrawn and the soil sample collected.

The hand auger can be used in a wide variety of soil conditions. It can be used to sample soil either from the surface, or to depths in excess of 12 feet. However, the presence of subsurface rocks and landfill material and collapse of the borehole normally limit sampling depth.

To accomplish soil sampling using a hand augering system, the following equipment is required:

- Complete hand auger assembly (variety of bucket bit sizes)
- Stainless steel mixing bowls
- The equipment listed in Section 6.3
- Miscellaneous hand tools as required to assemble and disassemble the hand auger units

CAUTION

Potential hazards associated with hand augering include:

- Muscle strain and sprain due to over twisting and/or over compromising yourself.
- Equipment failure due to excessive stress on the T-handle or rods through twisting. Failure of any of these components will result in a sudden release and potential injury due to that failure.

As in all situations, any intrusive activities that could damage underground utilities shall be preceded by a Dig/Excavation permit/ticket. Call the Utility Locating service in the area or your Project Health and Safety Officer for more information. When in doubt – **Get the Ticket!**

To obtain soil samples using a hand auger, use the following procedure:

1. Wearing designated PPE, attach a properly decontaminated bucket bit to a clean extension rod and attach the T-handle to the extension rod.
2. Clear the area to be sampled of any surface debris (vegetation, twigs, rocks, litter, etc.).
3. Twist the bucket into the ground while pushing vertically downward on the auger. The cutting shoes fill the bucket as it is advanced into the ground.
4. As the auger bucket fills with soil, periodically remove any unneeded soil.

Subject SOIL SAMPLING	Number SA-1.3	Page 16 of 31
	Revision 9	Effective Date 04/07/2008

5. Add rod extensions as necessary to extend the reach of the auger. Also, note (in a field notebook, boring log, and/or on a standardized data sheet) any changes in the color, texture or odor of the soil as a function of depth. The project-specific planning document (SAP, HASP, etc.) describe requirements for scanning the soil with a real-time air monitoring instrument (e.g., PID, FID, etc.) and recording the measurements.
6. After reaching the desired depth (e.g., the top of the interval to be sampled), slowly and carefully withdraw the apparatus from the borehole to prevent or minimize movement of soil from shallower intervals to the bottom of the hole.
7. Remove the soiled bucket bit from the rod extension and replace it with another properly decontaminated bucket bit. The bucket bit used for sampling is to be smaller in diameter than the bucket bit employed to initiate the borehole.
8. Carefully lower the apparatus down the borehole. Care must be taken to avoid scraping the borehole sides.
9. Slowly turn the apparatus until the bucket bit is advanced approximately 6 inches.
10. Discard the top of the core (approximately 1 inch), which represents any loose material collected by the bucket bit before penetrating the sample material.
11. Using a precleaned syringe or EnCore™ samplers, follow the procedure in Section 6.2.1 for collecting a soil sample for volatile compound analysis directly from the bucket bit.
12. Utilizing a properly decontaminated stainless steel trowel or dedicated disposable trowel, remove the remaining sample material from the bucket bit and place into a properly decontaminated stainless steel mixing bowl.
13. Homogenize the sample material as thoroughly as practicable then fill the remaining sample containers. Refer to Section 6.2.2.
14. Follow steps 4 through 7 listed in Section 6.3.

6.5.1 Sampling Using Stainless Steel Soil Corers

A soil corer is a stainless steel tube equipped with a cutting shoe and sample window in the side. The soil corer is advanced into the soil by applying downward pressure (body weight). The soil is unloaded by then forcing a ram towards the cutting shoe, which results in the discharge of the soil core through a window in the sleeve.

Use, application, and sample protocol is the same as for hand augering provided above, but without necessarily rotating the corer while advancing it.

SAFETY REMINDER

Hand augering and soil corer sampling can be physically demanding based on the type of geology and subsurface encumbrances encountered. Soil coring has some added hazards such the corer collapsing under your weight. To reduce the potential for muscle strain and damage, the following measures will be incorporated:

- Stretch and limber your muscles before heavy exertion. This hazard becomes more predominant in the early morning hours (prior to muscles becoming limber) and later in the day (as a result of fatigue).

Subject SOIL SAMPLING	Number SA-1.3	Page 17 of 31
	Revision 9	Effective Date 04/07/2008

- Job rotation – Share the duties so that repetitive actions do not result in fatigue and injury.
- Increase break frequencies as needed, especially as ambient conditions of heat and/or cold stress may dictate.
- Do not force the hand tools or use cheater pipes or similar devices to bypass an obstruction. Move to another location near the sampling point. Exerting additional forces on the sampling devices can result in damage and/or failure that could potentially injure someone in the immediate vicinity.
- Do not over compromise yourself when applying force to the soil corer or hand auger. If there is a sudden release, it could result in a fall or muscle injury due to strain.

6.6 Subsurface Soil Sampling with a Split-Barrel Sampler

A split-barrel (split-spoon) sampler consists of a heavy carbon steel or stainless steel sampling tube that can be split into two equal halves to reveal the soil sample (see Attachment B). A drive head is attached to the upper end of the tube and serves as a point of attachment for the drill rod. A removable tapered nosepiece/drive shoe attaches to the lower end of the tube and facilitates cutting. A basket-like sample retainer can be fitted to the lower end of the split tube to hold loose, dry soil samples in the tube when the sampler is removed from the drill hole. This split-barrel sampler is made to be attached to a drill rod and forced into the ground by means of a 140-pound or larger casing driver.

Safety Reminder

It is intended through the Equipment Inspection for Drill Rigs form provided in the HASP that the hammer and hemp rope, where applicable, associated with this activity will be inspected (no physical damage is obvious), properly attached to the hammer (suitable knots or sufficient mechanical devices), and is in overall good condition.

Split-barrel samplers are used to collect soil samples from a wide variety of soil types and from depths greater than those attainable with other soil sampling equipment.

The following equipment is used for obtaining split-barrel samples:

- Drilling equipment (provided by subcontractor).
- Split-barrel samplers (2-inch OD, 1-3/8-inch ID, either 20 inches or 26 inches long); Larger OD samplers are available if a larger volume of sample is needed.
- Drive weight assembly, 140-pound weight, driving head, and guide permitting free fall of 30 inches.
- Stainless steel mixing bowls.
- Equipment listed in Section 6.3.

The following steps shall be followed to obtain split-barrel samples (Steps 1 through 4 are typically performed by the drilling subcontractor):

1. Attach the split-barrel sampler to the sampling rods.

Subject SOIL SAMPLING	Number SA-1.3	Page 18 of 31
	Revision 9	Effective Date 04/07/2008

2. Lower the sampler into the borehole inside the hollow stem auger bits.
3. Advance the split-barrel sampler by hammering the length (typically 18 or 24 inches) of the split-barrel sampler into the soil using 140-pound or larger hammer.
4. When the desired depth is achieved, extract the drill rods and sampler from the augers and/or borehole.
5. Detach the sampler from the drill rods.
6. Place the sampler securely in a vise so it can be opened using pipe wrenches.

CAUTION

Pipe wrenches are used to separate the split spoon into several components. The driller's helper should not apply excessive force through the use of cheater pipes or push or pull in the direction where, if the wrench slips, hands or fingers will be trapped against an immovable object.

7. Remove the drive head and nosepiece with the wrenches, and open the sampler to reveal the soil sample.
8. Immediately scan the sample core with a real-time air monitoring instrument (e.g., FID, PID, etc.) (as project-specific planning documents dictate). Carefully separate (or cut) the soil core, with a decontaminated stainless steel knife or trowel, at about 6-inch intervals while scanning the center of the core for elevated readings. Also scan stained soil, soil lenses, and anomalies (if present), and record readings.
9. If elevated vapor readings were observed, collect the sample scheduled for volatile analysis from the center of the core where elevated readings occurred. If no elevated readings were encountered, the sample material should be collected from the core's center (this area represents the least disturbed area with minimal atmospheric contact) (refer to Section 6.2.1).
10. Using the same trowel, remove remaining sample material from the split-barrel sampler (except for the small portion of disturbed soil usually found at the top of the core sample) and place the soil into a decontaminated stainless steel mixing bowl.
11. Homogenize the sample material as thoroughly as practicable then fill the remaining sample containers (refer to Section 6.2.2).
12. Follow steps 4 through 7 in Section 6.3.

6.7 Subsurface Soil Sampling Using Direct-Push Technology

Subsurface soil samples can be collected to depths of 40+ feet using DPT. DPT equipment, responsibilities, and procedures are described in SOP SA-2.5.

Subject SOIL SAMPLING	Number SA-1.3	Page 19 of 31
	Revision 9	Effective Date 04/07/2008

6.8 **Excavation and Sampling of Test Pits and Trenches**

6.8.1 **Applicability**

This subsection presents routine test pit or trench excavation techniques and specialized techniques that are applicable under certain conditions.

CAUTION

During the excavation of trenches or pits at hazardous waste sites, several health and safety concerns arise from the method of excavation. No personnel shall enter any test pit or excavation over 4 feet deep except as a last resort, and then only under direct supervision of a Competent Person (as defined in 29 CFR 1929.650 of Subpart P - Excavations). Whenever possible, all required chemical and lithological samples should be collected using the excavator bucket or other remote sampling apparatus. If entrance is required, all test pits or excavations must be stabilized by bracing the pit sides using specifically designed wooden, steel, or aluminum support structures or through sloping and benching. Personnel entering the excavation may be exposed to toxic or explosive gases and oxygen-deficient environments; therefore, monitoring will be conducted by the Competent Person to determine if it is safe to enter. Any entry into a trench greater than 4 feet deep will constitute a Confined Space Entry and must be conducted in conformance with OSHA standard 29 CFR 1910.146. In all cases involving entry, substantial air monitoring, before entry, appropriate respiratory gear and protective clothing determination, and rescue provisions are mandatory. There must be at least three people present at the immediate site before entry by one of the field team members. This minimum number of people will increase based on the potential hazards or complexity of the work to be performed. The reader shall refer to OSHA regulations 29 CFR 1926.650, 29 CFR 1910.120, 29 CFR 1910.134, and 29 CFR 1910.146. High-hazard entries such as this will be supported by members of the Health Sciences Group professionally trained in these activities.

Excavations are generally not practical where a depth of more than about 15 to 20-feet is desired, and they are usually limited to a few feet below the water table. In some cases, a pumping system may be required to control water levels within the pit, providing that pumped water can be adequately stored or disposed. If soil data at depths greater than 15-feet are required, the data are usually obtained through test borings instead of test pits.

In addition, hazardous wastes may be brought to the surface by excavation equipment. This material, whether removed from the site or returned to the subsurface, must be properly handled according to any and all applicable federal, state, and local regulations.

6.8.2 **Test Pit and Trench Excavation**

Test pits or trench excavations are constructed with the intent that they will provide an open view of subsurface lithology and/or disposal conditions that a boring will not provide. These procedures describe the methods for excavating and logging test pits and trenches installed to determine subsurface soil and rock conditions. Test pit operations shall be logged and documented (see Attachment C).

Test pits and trenches may be excavated by hand or power equipment to permit detailed descriptions of the nature and contamination of the in-situ materials. The size of the excavation will depend primarily on the following:

- The purpose and extent of the exploration

Subject SOIL SAMPLING	Number SA-1.3	Page 20 of 31
	Revision 9	Effective Date 04/07/2008

- The space required for efficient excavation
- The chemicals of concern
- The economics and efficiency of available equipment

Test pits normally have a cross section that is 4 to 10 feet square; test trenches are usually 3 to 6 feet wide and may be extended for any length required to reveal conditions along a specific line. The following table provides guidelines for design consideration based on equipment efficiencies.

Equipment	Typical Widths, in Feet
Trenching machine	0.25 to 1.0
Backhoe/Track Hoe	2 to 6

The lateral limits of excavation of trenches and the position of test pits shall be carefully marked on area base maps. If precise positioning is required to indicate the location of highly hazardous materials, nearby utilities, or dangerous conditions, the limits of the excavation shall be surveyed. Also, if precise determination of the depth of buried materials is needed for design or environmental assessment purposes, the elevation of the ground surface at the test pit or trench location shall also be determined by survey. If the test pit/trench will not be surveyed immediately, it shall be backfilled and its position identified with stakes placed in the ground at the margin of the excavation for later surveying.

The construction of test pits and trenches shall be planned and designed in advance as much as possible. However, the following field conditions may necessitate revisions to the initial plans:

- Subsurface utilities
- Surface and subsurface encumbrances
- Vehicle and pedestrian traffic patterns
- Purpose for excavation (e.g., the excavation of potential ordnance items)

The final depth and construction method shall be collectively determined by the FOL and designated Competent Person. The actual layout of each test pit, temporary staging area, and spoils pile may further be predicated based on site conditions and wind direction at the time the test pit is excavated. Prior to excavation, the area may be surveyed by magnetometer or metal detector or other passive methods specified in SOP HS1.0, Utility Location and Excavation Clearance, to identify the presence of underground utilities or drums. Where possible, the excavator should be positioned upwind and preferably within an enclosed cab.

No personnel shall enter any test pit or excavation except as a last resort, and then only under direct supervision of a Competent Person. If entrance is required, OSHA requirements must be met (e.g., walls must be braced with wooden or steel braces, ladders must be placed for every 25 feet of lateral travel and extended 3 feet above ground surface). A temporary guard rail or vehicle stop must be placed along the surface of the hole before entry in situations where the excavation may be approached by traffic. Spoils will be stockpiled no closer than 2 feet from the sidewall of the excavation. The excavation equipment operator shall be careful not to undercut sidewalls and will, where necessary, bench back to increase stability. The top cover, when considered clean, will be placed separately from the subsurface materials to permit clean cover. It is emphasized that the project data needs should be structured such that required samples can be collected without requiring entrance into the excavation. For example,

Subject SOIL SAMPLING	Number SA-1.3	Page 21 of 31
	Revision 9	Effective Date 04/07/2008

samples of leachate, groundwater, or sidewall soil can be collected with telescoping poles or similar equipment.

Dewatering and watering may be required to ensure the stability of the side walls, to prevent the bottom of the pit from heaving, and to keep the excavation stable. This is an important consideration for excavations in cohesionless material below the groundwater table and for excavations left open greater than a day. Liquids removed as a result of dewatering operations must be handled as potentially contaminated materials. Procedures for the collection and disposal of such materials should be discussed in the site-specific project plans.

Where possible excavations and test pits shall be opened and closed within the same working day. Where this is not possible, the following engineering controls shall be put in place to control access:

- Trench covers/street plates
- Fences encompassing the entire excavation intended to control access
- Warning signs warning personnel of the hazards
- Amber flashing lights to demarcate boundaries of the excavation at night

Excavations left open will have emergency means to exit should someone accidentally enter.

6.8.3 Sampling in Test Pits and Trenches

6.8.3.1 General

Log test pits and trenches as they are excavated in accordance with the Test Pit Log presented in Attachment C. These records include plan and profile sketches of the test pit/trench showing materials encountered, their depth and distribution in the pit/trench, and sample locations. These records also include safety and sample screening information.

Entry of test pits by personnel is extremely dangerous, shall be avoided unless absolutely necessary, and can occur only after all applicable health and safety and OSHA requirements have been met as stated above. These provisions will be reiterated as appropriate in the project-specific HASP.

The final depth and type of samples obtained from each test pit will be determined at the time the test pit is excavated. Sufficient samples are usually obtained and analyzed to quantify contaminant distribution as a function of depth for each test pit. Additional samples of each waste phase and any fluids encountered in each test pit may also be collected.

In some cases, samples of soil may be extracted from the test pit for reasons other than waste sampling and chemical analysis, for instance, to obtain geotechnical information. Such information includes soil types, stratigraphy, strength, etc., and could therefore entail the collection of disturbed (grab or bulk) or relatively undisturbed (hand-carved or pushed/driven) samples that can be tested for geotechnical properties. The purposes of such explorations are very similar to those of shallow exploratory or test borings, but often test pits offer a faster, more cost-effective method of sampling than installing borings.

6.8.3.2 Sampling Equipment

The following equipment is needed for obtaining samples for chemical or geotechnical analysis from test pits and trenches:

Subject SOIL SAMPLING	Number SA-1.3	Page 22 of 31
	Revision 9	Effective Date 04/07/2008

- Backhoe or other excavating machinery.
- Shovels, picks, hand augers, and stainless steel trowels/disposable trowels.
- Sample container - bucket with locking lid for large samples; appropriate bottle ware for chemical or geotechnical analysis samples.
- Polyethylene bags for enclosing sample containers; buckets.
- Remote sampler consisting of 10-foot sections of steel conduit (1-inch-diameter), hose clamps, and right angle adapter for conduit (see Attachment D).

6.8.3.3 Sampling Methods

The methods discussed in this section refer to test pit sampling from grade level. If test pit entry is required, see Section 6.8.3.4.

- Excavate the trench or pit in several 0.5- to 1.0-foot depth increments. Where soil types support the use of a sand bar cutting plate, use of this device is recommended to avoid potentially snagging utilities with the excavator teeth. It is recommended that soil probes or similar devices be employed where buried items or utilities may be encountered. This permits the trench floor to be probed prior to the next cut.
- After each increment:
 - the operator shall wait while the sampler inspects the test pit from grade level
 - the sampler shall probe the next interval where this is considered necessary. Practical depth increments for lithological evaluations may range from 2 to 4 feet i or where lithological changes are noted.
- The backhoe operator, who will have the best view of the test pit, shall immediately cease digging if:
 - Any fluid phase, including groundwater seepage, is encountered in the test pit
 - Any drums, other potential waste containers, obstructions, or utility lines are encountered
 - Distinct changes of material being excavated are encountered

This action is necessary to permit proper sampling of the test pit and to prevent a breach of safety protocol. Depending on the conditions encountered, it may be required to excavate more slowly and carefully with the backhoe.

For obtaining test pit samples from grade level, the following procedure shall be followed:

- Use the backhoe to remove loose material from the excavation walls and floor to the greatest extent possible.
- Secure the walls of the pit, if necessary. (There is seldom any need to enter a pit or trench that would justify the expense of shoring the walls. All observations and samples should be taken from the ground surface.)

Subject SOIL SAMPLING	Number SA-1.3	Page 23 of 31
	Revision 9	Effective Date 04/07/2008

- Samples of the test pit material are to be obtained either directly from the backhoe bucket or from the material after it has been deposited on the ground, as follows:
 - a. The sampler or FOL shall direct the backhoe operator to remove material from the selected depth or location within the test pit/trench.
 - b. The backhoe operator shall bring the bucket over to a designated location on the sidewall a sufficient distance from the pit (at least 5 feet) to allow the sampler to work around the bucket.
 - c. After the bucket has been set on the ground, the backhoe operator shall either disengage the controls or shut the machine down.
 - d. When signaled by the operator that it is safe to do, the sampler will approach the bucket.
 - e. The soil shall be monitored with a photoionization or flame ionization detector (PID or FID) as directed in the project -specific planning documents.
 - f. The sampler shall collect the sample from the center of the bucket or pile in accordance with surface soil sampling procedures of Section 6.3 or 6.4, as applicable. Collecting samples from the center of a pile or bucket eliminates cross-contamination from the bucket or other depth intervals.
- If a composite sample is desired, several depths or locations within the pit/trench will be selected, and the bucket will be filled from each area. It is preferable to send individual sample bottles filled from each bucket to the laboratory for compositing under the more controlled laboratory conditions. However, if compositing in the field is required, each sample container shall be filled from materials that have been transferred into a mixing bucket and homogenized. Note that homogenization/compositing is not applicable for samples to be subjected to volatile organic analysis.

CAUTION

Care must be exercised when using the remote sampler described in the next step because of potential instability of trench walls. In situations where someone must move closer than 2 feet to the excavation edge, a board or platform should be used to displace the sampler's weight to minimize the chance of collapse of the excavation edge. Fall protection should also be employed when working near the edges or trenches greater than 6 feet deep. An immediate means to extract people who have fallen into the trench will be immediately available. These means may include ladders or rope anchor points.

- Using the remote sampler shown in Attachment D, samples can be taken at the desired depth from the sidewall or bottom of the pit as follows:
 - a. Scrape the face of the pit/trench using a long-handled shovel or hoe to remove the smeared zone that has contacted the backhoe bucket.
 - b. Collect the sample directly into the sample jar, by scraping with the jar edge, eliminating the need for sample handling equipment and minimizing the likelihood of cross-contamination.
 - c. Cap the sample jar, remove it from the remote sampler assembly, and package the sample for shipment in accordance with SOP SA-6.3.
- Complete documentation as described in SOP SA-6.3 and Attachment C of this SOP.

Subject SOIL SAMPLING	Number SA-1.3	Page 24 of 31
	Revision 9	Effective Date 04/07/2008

6.8.3.4 In-Pit Sampling

Under rare conditions, personnel may be required to enter the test pit/trench. This is necessary only when soil conditions preclude obtaining suitable samples from the backhoe bucket (e.g., excessive mixing of soil or wastes within the test pit/trench) or when samples from relatively small discrete zones within the test pit are required. This approach may also be necessary to sample any seepage occurring at discrete levels or zones in the test pit that are not accessible with remote samplers.

In general, personnel shall sample and log pits and trenches from the ground surface, except as provided for by the following criteria:

- There are no practical alternative means of obtaining such data.
- The SSO and Competent Person determine that such action can be accomplished without breaching site safety protocol. This determination will be based on actual monitoring of the pit/trench after it is dug (including, at a minimum, measurements of oxygen concentration, flammable gases, and toxic compounds, in that order). Action levels will be provided in project-specific planning documents.
- A company-designated Competent Person determines that the pit/trench is stable through soil classification evaluation/inspections or is made stable (by cutting/grading the sidewalls or using shoring) prior to entrance of any personnel. OSHA requirements shall be strictly observed.

If these conditions are satisfied, only one person may enter the pit/trench. On potentially hazardous waste sites, this individual shall be dressed in selected PPE as required by the conditions in the pit. He/she shall be affixed to a harness and lifeline and continuously monitored while in the pit.

A second and possible third individual shall be fully dressed in protective clothing including a self-contained breathing device and on standby during all pit entry operations to support self rescue or assisted self rescue. The individual entering the pit shall remain therein for as brief a period as practical, commensurate with performance of his/her work. After removing the smeared zone, samples shall be obtained with a decontaminated trowel or spoon.

6.8.3.5 Geotechnical Sampling

In addition to the equipment described in Section 6.8.3.2, the following equipment is needed for geotechnical sampling:

- Soil sampling equipment, similar to that used in shallow drilled boring (i.e., thin-walled tube samplers), that can be pushed or driven into the floor of the test pit.
- Suitable driving (e.g., sledge hammer) or pushing (e.g., backhoe bucket) equipment used to advance the sampler into the soil.
- Knives, spatulas, and other suitable devices for trimming hand-carved samples.
- Suitable containers (bags, jars, tubes, boxes, etc.), labels, wax, etc. for holding and safely transporting collected soil samples.
- Geotechnical equipment (pocket penetrometer, torvane, etc.) for field testing collected soil samples for classification and strength properties.

Subject SOIL SAMPLING	Number SA-1.3	Page 25 of 31
	Revision 9	Effective Date 04/07/2008

Disturbed grab or bulk geotechnical soil samples may be collected for most soil in the same manner as comparable soil samples for chemical analysis. These collected samples may be stored in jars or plastic-lined sacks (larger samples), which will preserve their moisture content. Smaller samples of this type are usually tested for their index properties to aid in soil identification and classification: larger bulk samples are usually required to perform compaction tests.

Relatively undisturbed samples are usually extracted in cohesive soil using thin-walled tube samplers, and such samples are then tested in a geotechnical laboratory for their strength, permeability, and/or compressibility. The techniques for extracting and preserving such samples are similar to those used in performing Shelby tube sampling in borings, except that the sampler is advanced by hand or backhoe, rather than by a drill rig. Also, the sampler may be extracted from the test pit by excavation around the tube when it is difficult to pull it out of the ground. If this excavation requires entry of the test pit, the requirements described in Section 6.8.3.4 shall be followed. The thin-walled tube sampler shall be pushed or driven vertically into the floor or steps excavated in the test pit at the desired sampling elevations. Extracting tube samples horizontally from the walls of the test pit is not appropriate because the sample will not have the correct orientation.

A sledge hammer or backhoe may be used to drive or push the tube into the ground. Place a piece of wood over the top of the sampler or sampling tube to prevent damage during driving/pushing of the sample. Pushing the sampler with a constant thrust is always preferable to driving it with repeated blows, thus minimizing disturbance to the sample. When using a sledge hammer, it is recommended that the sampler be stabilized using a rope/strap wrench or pipe wrench to remove the person's hands holding the sampler from the strike zone. If the sample cannot be extracted by rotating it at least two revolutions (to shear off the sample at the bottom), hook the sampler to the excavator or backhoe and extract. This means an alternative head will be used as a connection point or that multiple choke hitches will be applied to extract the sampler. If this fails and the excavator can dig deeper without potentially impacting subsurface utilities, excavate the sampler. If this fails or if the excavator cannot be used due to subsurface utilities, hand-excavate to remove the soil from around the sides of the sampler. If hand-excavation requires entry into the test pit, the requirements in Section 6.8.3.4 must be followed. Prepare the sample as described in Steps 9 through 13 in Section 6.2.3, and label, pack and transport the sample in the required manner, as described in SOPs SA-6.3 and SA-6.1.

6.8.4 Backfilling of Trenches and Test Pits

All test pits and excavations must be either backfilled, covered, or otherwise protected at the end of each day. No excavations shall remain open during non-working hours unless adequately covered or otherwise protected.

Before backfilling, the onsite crew may photograph, if required by the project-specific work plan, all significant features exposed by the test pit and trench and shall include in the photograph a scale to show dimensions. Photographs of test pits shall be marked to include site number, test pit number, depth, description of feature, and date of photograph. In addition, a geologic description of each photograph shall be entered in the site logbook. All photographs shall be indexed and maintained as part of the project file for future reference.

After inspection, backfill material shall be returned to the pit under the direction of the FOL. Backfill should be returned to the trench or test pit in 6-inch to 1-foot lifts and compacted with the bucket. Remote controlled tampers or rollers may be lowered into the trench and operated from top side. This procedure will continue to the grade surface. It is recommended that the trench be tracked or rolled in. During excavation, clean soil from the top 2 feet may have been separated to be used to cover the last segments. Where these materials are not clean, it is recommended that clean fill be used for the top cover.

Subject SOIL SAMPLING	Number SA-1.3	Page 26 of 31
	Revision 9	Effective Date 04/07/2008

If a low-permeability layer is penetrated (resulting in groundwater flow from an upper contaminated flow zone into a lower uncontaminated flow zone), backfill material must represent original conditions or be impermeable. Backfill could consist of a soil-bentonite mix prepared in a proportion specified by the FOL (representing a permeability equal to or less than original conditions). Backfill can be covered by "clean" soil and graded to the original land contour. Revegetation of the disturbed area may also be required.

6.9 Records

The appropriate sample log sheet (see Attachment A of this SOP) must be completed by the site geologist/sampler for all samples collected. All soil sampling locations should be documented by tying in the location of two or more nearby permanent landmarks (building, telephone pole, fence, etc.) or obtaining GPS coordinates; and shall be noted on the appropriate sample log sheet, site map, or field notebook. Surveying may also be necessary, depending on the project requirements.

Test pit logs (see Attachment C of this SOP) shall contain a sketch of pit conditions. If the project-specific work plan requires photographs, at least one photograph with a scale for comparison shall be taken of each pit. Included in the photograph shall be a card showing the test pit number. Boreholes, test pits, and trenches shall be logged by the field geologist in accordance with SOP GH-1.5.

Other data to be recorded in the field logbook include the following:

- Name and location of job
- Date of boring and excavation
- Approximate surface elevation
- Total depth of boring and excavation
- Dimensions of pit
- Method of sample acquisition
- Type and size of samples
- Soil and rock descriptions
- Photographs if required
- Groundwater levels
- PID/FID/LEL/O₂ meter readings
- Other pertinent information, such as waste material encountered

In addition, site-specific documentation to be maintained by the SSO and/or Competent Person will be required including:

- Calibration logs
- Excavation inspection checklists

Subject SOIL SAMPLING	Number SA-1.3	Page 27 of 31
	Revision 9	Effective Date 04/07/2008

- Soil type classification

7.0 REFERENCES

American Society for Testing and Materials, 1987. ASTM Standards D1587-83 and D1586-84. ASTM Annual Book of Standards. ASTM. Philadelphia, Pennsylvania. Volume 4.08.

NUS Corporation, 1986. Hazardous Material Handling Training Manual.

NUS Corporation and CH2M Hill, August, 1987. Compendium of Field Operation Methods. Prepared for the U.S. EPA.

OSHA, Excavation, Trenching and Shoring 29 CFR 1926.650-653.

OSHA, Confined Space Entry 29 CFR 1910.146.

USEPA, November 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual.

Subject SOIL SAMPLING	Number SA-1.3	Page 28 of 31
	Revision 9	Effective Date 04/07/2008

ATTACHMENT A SOIL & SEDIMENT SAMPLE LOG SHEET



Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: _____		Sample ID No.: _____	
Project No.: _____		Sample Location: _____	
<input type="checkbox"/> Surface Soil <input type="checkbox"/> Subsurface Soil <input type="checkbox"/> Sediment <input type="checkbox"/> Other: _____ <input type="checkbox"/> QA Sample Type: _____		Sampled By: _____ C.O.C. No.: _____ Type of Sample: <input type="checkbox"/> Low Concentration <input type="checkbox"/> High Concentration	

GRAB SAMPLE DATA:			
Date: _____	Depth: _____	Color: _____	Description (Sand, Silt, Clay, Moisture, etc.) _____
Time: _____			
Method: _____			
Monitor Reading (ppm): _____			

COMPOSITE SAMPLE DATA:				
Date: _____	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method: _____				
Monitor Readings (Range in ppm): _____				

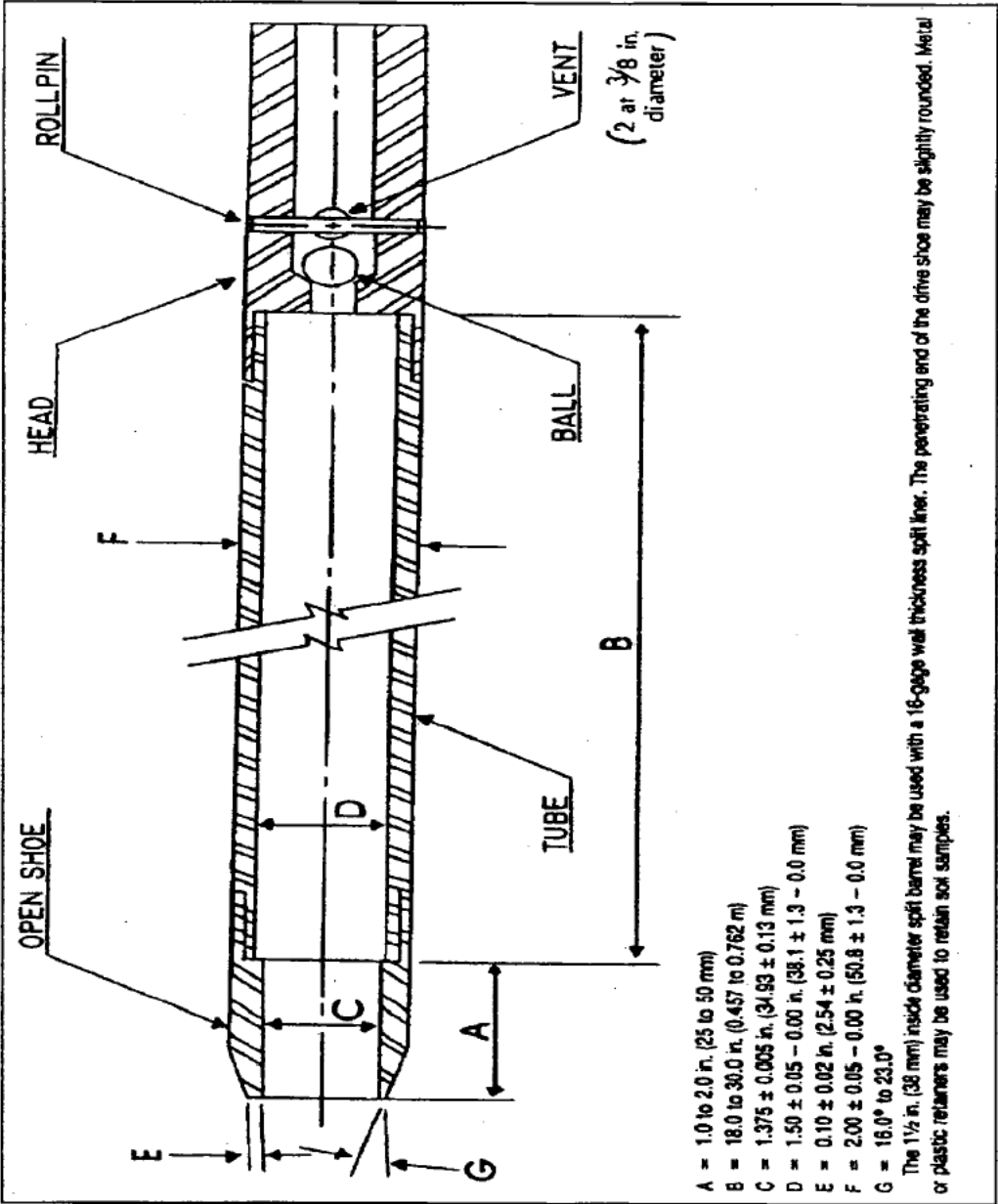
SAMPLE COLLECTION INFORMATION:			
Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:	MAP:

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.: _____	

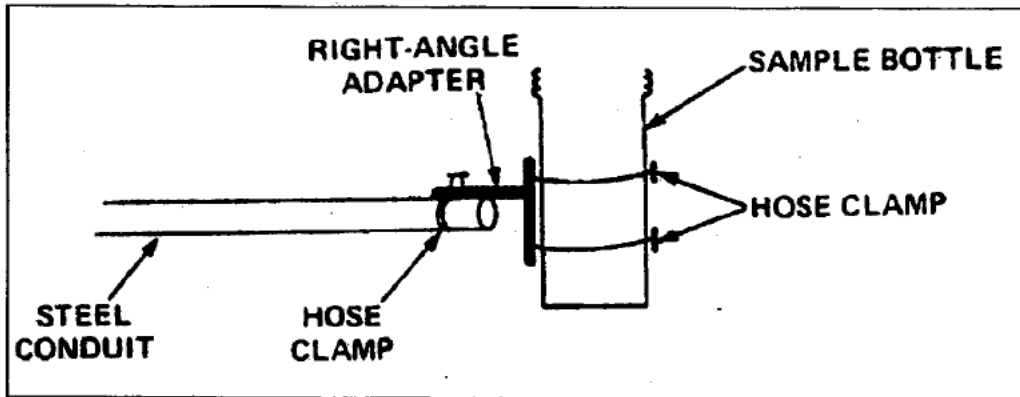
Subject SOIL SAMPLING	Number SA-1.3	Page 29 of 31
	Revision 9	Effective Date 04/07/2008

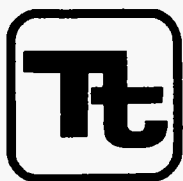
ATTACHMENT B
SPLIT-SPOON SAMPLER



Subject SOIL SAMPLING	Number SA-1.3	Page 31 of 31
	Revision 9	Effective Date 04/07/2008

**ATTACHMENT D
REMOTE SAMPLE HOLDER FOR TEST PIT/TRENCH SAMPLING**





TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number	SA-2.5	Page	1 of 6
Effective Date	09/03	Revision	3
Applicability	Tetra Tech NUS, Inc.		
Prepared	Earth Sciences Department		
Approved	D. Senovich <i>DS</i>		

Subject DIRECT PUSH TECHNOLOGY
(GEOPROBE®/HYDROPUNCH™)

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE	2
2.0 SCOPE	2
3.0 GLOSSARY	2
4.0 RESPONSIBILITIES	2
5.0 SOIL SAMPLING PROCEDURES	3
5.1 GENERAL	3
5.2 SAMPLING EQUIPMENT	3
5.3 DPT SAMPLING METHODOLOGY	3
6.0 GROUNDWATER SAMPLING PROCEDURES	4
6.1 GENERAL	4
6.2 SAMPLING EQUIPMENT	4
6.3 DPT TEMPORARY WELL POINT INSTALLATION AND SAMPLING METHODOLOGY	5
7.0 RECORDS	5
 <u>ATTACHMENTS</u>	
1 SAFE WORK PERMIT	6

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 2 of 6
	Revision 3	Effective Date 09/03

1.0 PURPOSE

The purpose of this procedure is to provide general reference information on Direct Push Technology (DPT). DPT is designed to collect soil, groundwater, and soil gas samples without using conventional drilling techniques. The advantage of using DPT over conventional drilling includes the generation of little or no drill cuttings, sampling in locations with difficult accessibility, reduced overhead clearance requirements, no fluid introduction during probing, and typical lower costs per sample than with conventional techniques. Disadvantages include a maximum penetration depth of approximately 15 to 40 feet in dense soils (although it may be as much as 60 to 80 feet in certain types of geological environments), reduced capability of obtaining accurate water-level measurements, and the inability to install permanent groundwater monitoring wells. The methods and equipment described herein are for collection of surface and subsurface soil samples and groundwater samples. Soil gas sampling is discussed in SOP SA-2.4.

2.0 SCOPE

This procedure provides information on proper sampling equipment and techniques for DPT. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described shall be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments in methodology.

3.0 GLOSSARY

Direct Push Technology (DPT) - DPT refers to sampling tools and sensors that are driven directly into the ground without the use of conventional drilling equipment. DPT typically utilizes hydraulic pressure and/or percussion hammers to advance the sampling tools. A primary advantage of DPT over conventional drilling techniques is that DPT results in the generation of little or no investigation derived waste.

Geoprobe® - Geoprobe® is a manufacturer of a hydraulically-powered, percussion/probing machines utilizing DPT to collect subsurface environmental samples. Geoprobe® relies on a relatively small amount of static weight (vehicle) combined with percussion as the energy for advancement of a tool string. The Geoprobe® equipment can be mounted in a multitude of vehicles for access to all types of environmental sites.

HydroPunch™ - HydroPunch™ is a manufacturer of stainless steel and Teflon® sampling tools that are capable of collecting representative groundwater and/or soil samples without requiring the installation of a groundwater monitoring well or conventional soil boring. HydroPunch™ is an example of DPT sampling equipment.

Flame Ionization Detector (FID) - A portable instrument for the measurement of many combustible organic compounds and a few inorganic compounds in air at parts-per million levels. The basis for the detection is the ionization of gaseous species utilizing a flame as the energizing source.

Photo Ionization Detector (PID) - A portable instrument for the measurement of many combustible organic compounds and a few inorganic compounds in air at parts-per million levels. The basis for the detection is the ionization of gaseous species utilizing ultraviolet radiation as the energizing source.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for selecting and/or reviewing the appropriate DPT drilling procedure required to support the project objectives.

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 3 of 6
	Revision 3	Effective Date 09/03

Field Operations Leader (FOL)- The FOL is primarily responsible for performing the DPT in accordance with the project-specific plan.

5.0 SOIL SAMPLING PROCEDURES

5.1 General

The common methodology for the investigation of the vadose zone is soil boring drilling and soil sampling. However, drilling soil borings can be very expensive. Generally the advantage of DPT for subsurface soil sampling is the reduced cost of disposal of drilling cuttings and shorter sampling times.

5.2 Sampling Equipment

Equipment needed for conducting DPT drilling for subsurface soil sampling includes, but is not limited to, the following:

- Geoprobe® Sampling Kit
- Cut-resistant gloves
- 4-foot x 1.5-inch diameter macrocore sampler
- Probe sampling adapters
- Roto-hammer with 1.5-inch bit
- Disposable acetate liners for soil macrocore sampler
- Cast aluminum or steel drive points
- Geoprobe® AT-660 Series Large Bore Soil Sampler, or equivalent
- Standard decontamination equipment and solutions

For health and safety equipment and procedures, follow the direction provided in the Safe Work Permit in Attachment 1, or the more detailed directions provided in the project's Health and Safety Plan.

5.3 DPT Sampling Methodology

There are several methods for the collection of soil samples using DPT drilling. The most common method is discussed in the following section. Variations of the following method may be conducted upon approval of the Project Manager in accordance with the project-specific plan.

- Macrocore samplers fitted with detachable aluminum or steel drive points are driven into the ground using hydraulic pressure. If there is concrete or pavement over a sampling location, a Roto-hammer is used to drill a minimum 1.5-inch diameter hole through the surface material. A Roto-hammer may also be used if very dense soils are encountered.
- The sampler is advanced continuously in 4-foot intervals or less if desired. No soil cuttings are generated because the soil which is not collected in the sampler is displaced within the formation.
- The sampler is retracted from the hole, and the 4-foot continuous sample is removed from the outer coring tube. The sample is contained within an inner acetate liner.
- Attach the metal trough from the Geoprobe® Sampling Kit firmly to the tail gate of a vehicle. If a vehicle with a tail gate is not available, secure the trough on another suitable surface.
- Place the acetate liner containing the soils in the trough.

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 4 of 6
	Revision 3	Effective Date 09/03

- While wearing cut-resistant gloves (constructed of leather or other suitable material), cut the acetate liner through its entire length using the double-bladed knife that accompanies the Geoprobe® Sampling Kit. Then remove the strip of acetate from the trough to gain access to the collected soils. Do not attempt to cut the acetate liner while holding it in your hand.
- Field screen the sample with an FID or PID, and observe/examine the sample (according to SOP GH-1.3). If appropriate, transfer the sample to sample bottles for laboratory analysis. If additional volume is required, push an additional boring adjacent to the first and composite/mix the same interval. Field compositing is usually not acceptable for sample requiring volatile organics analysis.
- Once sampling has been completed, the hole is backfilled with bentonite chips or bentonite cement grout, depending upon project requirements. Asphalt or concrete patch is used to cap holes through paved or concrete areas. All holes should be finished smooth to existing grade.
- In the event the direct push van/truck cannot be driven to a remote location or a sampling location with difficult accessibility, sampling probes may be advanced and sampled manually or with air/electric operated equipment (e.g., jack hammer).
- Sampling equipment is decontaminated prior to collecting the next sample.

6.0 GROUNDWATER SAMPLING PROCEDURES

6.1 General

The most common methodology for the investigation of groundwater is the installation and sampling of permanent monitoring wells. If only groundwater screening is required, the installation and sampling of temporary well points may be performed. The advantage of temporary well point installation using DPT is reduced cost due to no or minimal disposal of drilling cuttings and well construction materials, and shorter installation/times sampling.

Two disadvantages of DPT drilling for well point installation are:

- In aquifers with low yields, well points may have to be sampled without purging or development.
- If volume requirements are high, this method can be time consuming for low yield aquifers.

6.2 Sampling Equipment

Equipment needed for temporary well installation and sampling using DPT includes, but is not limited, to the following:

- 2-foot x 1-inch diameter mill-slotted (0.005 to 0.02-inch) well point
- Connecting rods
- Roto-hammer with 1.5-inch bit
- Mechanical jack
- 1/4-inch OD polyethylene tubing
- 3/8-inch OD polyethylene tubing
- Peristaltic pump
- Standard decontamination equipment and solutions

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 5 of 6
	Revision 3	Effective Date 09/03

6.3 DPT Temporary Well Point Installation and Sampling Methodology

There are several methods for the installation and sampling of temporary well points using DPT. The most common methodology is discussed below. Variations of the following method may be conducted upon approval of the Project Manager in accordance with the project specific plan.

- A 2-foot x 1-inch diameter mill-slotted (0.005 to 0.02-inch) well point attached to connecting rods is driven into the ground to the desired depth using a rotary electric hammer or other direct push drill rig. If there is concrete or pavement over a sampling location, a Roto-hammer or electric coring machine is used to drill a hole through the surface material.
- The well point will be allowed to equilibrate for at least 15 minutes, after which a measurement of the static water level will be taken. The initial measurement of the water level will be used to assess the amount of water which is present in the well point and to determine the amount of silt and sand infiltration that may have occurred.
- The well point will be developed using a peristaltic pump and polyethylene tubing to remove silt and sand which may have entered the well point. The well point is developed by inserting polyethylene tubing to the bottom of the well point and lifting and lowering the tubing slightly while the pump is operating. The pump will be operated at a maximum rate of approximately 2 liters per minute. After removal of sediment from the bottom of the well point, the well point will be vigorously pumped at maximum capacity until discharge water is visibly clear and no further sediments are being generated. Measurements of pH, specific conductance, temperature, and turbidity shall be recorded every 5 to 10 minutes during the purging process. After two consistent readings of pH, specific conductance, temperature and turbidity (± 10 percent), the well may be sampled.
- A sample will be collected using the peristaltic pump set at the same or reduced speed as during well development. Samples (with the exception of the samples to be analyzed for volatile organic compounds, VOCs) will be collected directly from the pump discharge. Sample containers for VOCs will be filled by (first shutting off the pump) crimping the discharge end of the sample tubing when filled, removing the inlet end of the sample tubing from the well, suspending the inlet tubing above the vial, and allowing water to fill each vial by gravity flow.
- Once the groundwater sample has been collected, the connecting rods and well point will be removed from the hole with the direct push rig hydraulics. The hole will be backfilled with bentonite chips or bentonite cement grout, depending upon project requirements. Asphalt or concrete patch will be used to cap holes through paved or concrete areas. All holes will be finished smooth to existing grade.
- In the event the direct push van/truck cannot be driven to a remote location or sampling location with difficult accessibility, sampling probes may be advanced and sampled manually or with air/electric-operated equipment (e.g., jack hammer).
- Decontaminate the equipment before moving to the next location.

7.0 RECORDS

A record of all field procedures, tests, and observations must be recorded in the field logbook, boring logs, and sample log sheets, as needed. Entries should include all pertinent data regarding the investigation. The use of sketches and field landmarks will help to supplement the investigation and evaluation.

Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)	Number SA-2.5	Page 6 of 6
	Revision 3	Effective Date 09/03

**ATTACHMENT 1
SAFE WORK PERMIT FOR DPT OPERATIONS**

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

- I. Work limited to the following (description, area, equipment used): **Monitoring well drilling and installation through direct push technology**
- II. Required Monitoring Instruments: _____
- III. Field Crew: _____
- IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

- V. Protective equipment required Respiratory equipment required
- | | | |
|--|--|--|
| Level D <input checked="" type="checkbox"/> Level B <input type="checkbox"/> | Full face APR <input type="checkbox"/> | Escape Pack <input type="checkbox"/> |
| Level C <input type="checkbox"/> Level A <input type="checkbox"/> | Half face APR <input type="checkbox"/> | SCBA <input type="checkbox"/> |
| Detailed on Reverse | SKA-PAC SAR <input type="checkbox"/> | Bottle Trailer <input type="checkbox"/> |
| | Skid Rig <input type="checkbox"/> | None <input checked="" type="checkbox"/> |

Level D Minimum Requirements: Sleeved shirt and long pants, safety footwear, and work gloves. Safety glasses, hard hats, and hearing protection will be worn when working near or sampling in the vicinity of the DPT rig.

Modifications/Exceptions.

- | VI. Chemicals of Concern | Action Level(s) | Response Measures |
|--------------------------|-----------------|-------------------|
| _____ | _____ | _____ |

VII. Additional Safety Equipment/Procedures

- | | |
|---|--|
| Hard-hat <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | Hearing Protection (Plugs/Muffs) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Safety Glasses <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | Safety belt/harness <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Chemical/splash goggles <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | Radio <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Splash Shield <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | Barricades <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Splash suits/coveralls <input type="checkbox"/> Yes <input type="checkbox"/> No | Gloves (Type - _____) <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Steel toe Work shoes or boots <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | Work/warming regimen <input type="checkbox"/> Yes <input type="checkbox"/> No |

Modifications/Exceptions: Reflective vests for high traffic areas.

- | | | | | |
|--|-------------------------------------|-------------------------------------|--------------------------|--------------------------|
| VIII. Procedure review with permit acceptors | Yes | NA | Yes | NA |
| Safety shower/eyewash (Location & Use)..... | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Daily tail gate meetings..... | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Contractor tools/equipment/PPE inspected | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Emergency alarms | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Evacuation routes | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Assembly points | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

IX. Site Preparation

- | | |
|---|--|
| Utility Clearances obtained for areas of subsurface investigation | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Physical hazards removed or blockaded | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Site control boundaries demarcated/signage | <input type="checkbox"/> Yes <input type="checkbox"/> No |

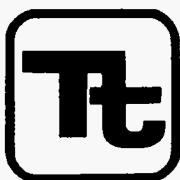
X. Equipment Preparation

- | | |
|--|---|
| Equipment drained/depressurized..... | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Equipment purged/cleaned..... | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Isolation checklist completed..... | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Electrical lockout required/field switch tested | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Blinds/misalignments/blocks & bleeds in place | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |
| Hazardous materials on walls/behind liners considered..... | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> NA |

- XI. Additional Permits required (Hot work, confined space entry). ☐ Yes ☐ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

XII. Special instructions, precautions:

Permit Issued by: _____ Permit Accepted by: _____



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number

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Page

1 of 11

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Tetra Tech NUS, Inc.

Prepared

Earth Sciences Department

Subject

NON-RADIOLOGICAL SAMPLE HANDLING

Approved

D. Senovich

TABLE OF CONTENTS

SECTION

PAGE

1.0	PURPOSE.....	2
2.0	SCOPE.....	2
3.0	GLOSSARY	2
4.0	RESPONSIBILITIES.....	3
5.0	PROCEDURES	3
5.1	SAMPLE CONTAINERS	3
5.2	SAMPLE PRESERVATION.....	3
5.2.1	Overview	4
5.2.2	Preparation and Addition of Reagents	4
5.3	FIELD FILTRATION	5
5.4	SAMPLE PACKAGING AND SHIPPING.....	6
5.4.1	Environmental Samples	6
6.0	REFERENCES.....	7

ATTACHMENTS

A	GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS.....	8
B	ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES	9

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 2 of 11
	Revision 3	Effective Date 02/04

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

2.0 SCOPE

This procedure describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.

3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of §172.101 and §172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173. With slight modifications, IATA has adopted DOT "hazardous materials" as IATA "Dangerous Goods."

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (y261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (y261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - H₂SO₄
- Nitric Acid - HNO₃
- Sodium Hydroxide - NaOH

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 3 of 11
	Revision 3	Effective Date 02/04

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - $\text{Na}_2\text{S}_2\text{O}_3$

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent.

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR §172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the shipper.

5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, head space shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of sample container orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded. Because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 4 of 11
	Revision 3	Effective Date 02/04

changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

5.2.1 Overview

The preservation techniques to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C. Medium-concentration aqueous samples, high-hazard organic samples, and some gas samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with HNO₃, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not cooled.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

The FOL is responsible for ensuring that an accurate Chemical Inventory is created and maintained for all hazardous chemicals brought to the work site (see Section 5 of the TtNUS Health and Safety Guidance Manual). Furthermore, the FOL must ensure that a corresponding Material Safety Data Sheet (MSDS) is collected for every substance entered on the site Chemical Inventory, and that all persons using/handling/ disposing of these substances review the appropriate MSDS for substances they will work with. The Chemical Inventory and the MSDSs must be maintained at each work site in a location and manner where they are readily-accessible to all personnel.

5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

Acid/Base	Dilution	Concentration	Estimated Amount Required for Preservation
Hydrochloric Acid (HCl)	1 part concentrated HCl: 1 part double-distilled, deionized water	6N	5-10 mL
Sulfuric Acid (H ₂ SO ₄)	1 part concentrated H ₂ SO ₄ : 1 part double-distilled, deionized water	18N	2 - 5 mL
Nitric Acid (HNO ₃)	Undiluted concentrated HNO ₃	16N	2 - 5 mL
Sodium Hydroxide (NaOH)	400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution	10N	2 mL

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample. This assumes that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required. Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 5 of 11
	Revision 3	Effective Date 02/04

- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.
- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).
- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for ascorbic acid addition.

If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

Continue with proper base preservation of the sample as described above.

- Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

The sample pH is then raised to 9 using the NaOH preservative.

- Sodium thiosulfate must be added to remove residual chlorine from a sample. To test the sample for residual chlorine use a field test kit specially made for this purpose.

If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

Continue with proper acidification of the sample as described above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory before sampling begins.

5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed prior to the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated tubing, and a peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 6 of 11
	Revision 3	Effective Date 02/04

- To perform filtration, thread the tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration. Run approximately 100 ml of sample through the filter and discard prior to sample collection.
- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

5.4 Sample Packaging and Shipping

Only employees who have successfully completed the TtNUS "Shipping Hazardous Materials" training course are authorized to package and ship hazardous substances. These trained individuals are responsible for performing shipping duties in accordance with this training.

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)
- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental samples are outlined in the remainder of this section.

5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place properly identified sample container, with lid securely fastened, in a plastic bag (e.g. Ziploc baggie), and seal the bag.
- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic bag (e.g. "garbage" bag). Drain plugs on coolers must be taped shut.
- Pack with enough cushioning materials such as bubble wrap (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.
- If cooling is required (see Attachments A and B), place ice around sample container shoulders, and on top of packing material (minimum of 8 pounds of ice for a medium-size cooler).
- Seal (i.e., tape or tie top in knot) large liner bag.
- The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the cooler containing the vials for VOC analysis. The COC form should then state how many coolers are included with that shipment.
- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 7 of 11
	Revision 3	Effective Date 02/04

Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

6.0 REFERENCES

American Public Health Association, 1981. Standard Methods for the Examination of Water and Wastewater, 15th Edition. APHA, Washington, D.C.

International Air Transport Association (latest issue). Dangerous Goods Regulations, Montreal, Quebec, Canada.

U.S. Department of Transportation (latest issue). Hazardous Materials Regulations, 49 CFR 171-177.

U.S. EPA, 1984. "Guidelines Establishing Test Procedures for the Analysis of Pollutants under Clean Water Act." Federal Register, Volume 49 (209), October 26, 1984, p. 43234.

U.S. EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, U.S. EPA-EMSL, Cincinnati, Ohio.

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 8 of 11
	Revision 3	Effective Date 02/04

ATTACHMENT A

GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample Type and Concentration	Container ⁽¹⁾	Sample Size	Preservation ⁽²⁾	Holding Time ⁽²⁾
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WATER

Organics (GC&GC/MS)	VOC	Low	Borosilicate glass	2 x 40 mL	Cool to 4°C HCl to ≤ 2	14 days ⁽⁹⁾
	Extractables SVOCs and pesticide/PCBs)	(Low	Amber glass	2x2 L or 4x1 L	Cool to 4°C	7 days to extraction; 40 days after extraction
	Extractables SVOCs and pesticide/PCBs)	(Medium	Amber glass	2x2 L or 4x1 L	None	7 days to extraction; 40 days after extraction
Inorganics	Metals	Low	High-density polyethylene	1 L	HNO ₃ to pH ≤2	6 months (Hg-28 days)
		Medium	Wide-mouth glass	16 oz.	None	6 months
	Cyanide	Low	High-density polyethylene	1 L	NaOH to pH>12	14 days
	Cyanide	Medium	Wide-mouth glass	16 oz.	None	14 days
Organic/ Inorganic	High Hazard		Wide-mouth glass	8 oz.	None	14 days

SOIL

Organics (GC&GC/MS)	VOC		EnCore Sampler	(3) 5 g Samplers	Cool to 4°C	48 hours to lab preservation
	Extractables SVOCs and pesticides/PCBs)	(Low	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
	Extractables SVOCs and pesticides/PCBs)	(Medium	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium		Wide-mouth glass	8 oz.	Cool to 4°C	6 months (Hg - 28 days) Cyanide (14 days)
Organic/Inorga nic	High Hazard		Wide-mouth glass	8 oz.	None	NA
Dioxin/Furan	All		Wide-mouth glass	4 oz.	None	35 days until extraction; 40 days after extraction
TCLP	All		Wide-mouth glass	8 oz.	None	7 days until preparation; analysis as per fraction

AIR

Volatile Organics	Low/Medium	Charcoal tube -- 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4°C	5 days recommended
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1 All glass containers should have Teflon cap liners or septa.

2 See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 9 of 11
	Revision 3	Effective Date 02/04

ATTACHMENT B

ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter Number/Name	Container ⁽¹⁾	Preservation ⁽²⁾⁽³⁾	Maximum Holding Time ⁽⁴⁾
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INORGANIC TESTS:

Acidity	P, G	Cool, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia - Nitrogen	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Chemical Oxygen Demand (COD)	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Chloride	P, G	None required	28 days
Chlorine, Total Residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C; NaOH to pH 12; 0.6 g ascorbic acid ⁽⁵⁾	14 days ⁽⁶⁾
Fluoride	P	None required	28 days
Hardness	P, G	HNO ₃ to pH 2; H ₂ SO ₄ to pH 2	6 months
Total Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Nitrate - Nitrogen	P, G	None required	48 hours
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Nitrite - Nitrogen	P, G	Cool, 4°C	48 hours
Oil & Grease	G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Total Organic Carbon (TOC)	P, G	Cool, 4°C; HCl or H ₂ SO ₄ to pH 2	28 days
Orthophosphate	P, G	Filter immediately; Cool, 4°C	48 hours
Oxygen, Dissolved-Probe	G Bottle & top	None required	Analyze immediately
Oxygen, Dissolved-Winkler	G Bottle & top	Fix on site and store in dark	8 hours
Phenols	G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Phosphorus, Total	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Residue, Total	P, G	Cool, 4°C	7 days
Residue, Filterable (TDS)	P, G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, Volatile (Ash Content)	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific Conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	28 days

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 10 of 11
	Revision 3	Effective Date 02/04

**ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES,
AND HOLDING TIMES
PAGE TWO**

Parameter Number/Name	Container ⁽¹⁾	Preservation ⁽²⁾⁽³⁾	Maximum Holding Time ⁽⁴⁾
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INORGANIC TESTS (Cont'd):

Sulfide	P, G	Cool, 4°C; add zinc acetate plus sodium hydroxide to pH 9	7 days
Sulfite	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours

METALS:⁽⁷⁾

Chromium VI (Hexachrome)	P, G	Cool, 4°C	24 hours
Mercury (Hg)	P, G	HNO ₃ to pH 2	28 days
Metals, except Chromium VI and Mercury	P, G	HNO ₃ to pH 2	6 months

ORGANIC TESTS:⁽⁸⁾

Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	14 days
Purgeable Aromatic Hydrocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾ HCl to pH 2 ⁽⁹⁾	14 days
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾ adjust pH to 4-5 ⁽¹⁰⁾	14 days
Phenols ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction; 40 days after extraction
Benzidines ^{(11), (12)}	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction ⁽¹³⁾
Phthalate esters ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitrosamines ^{(11), (14)}	G, Teflon-lined cap	Cool, 4°C; store in dark; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction; 40 days after extraction
PCBs ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitroaromatics & Isophorone ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾ ; store in dark	7 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons (PAHs) ^{(11), (14)}	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾ ; store in dark	7 days until extraction; 40 days after extraction
Haloethers ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction; 40 days after extraction
Dioxin/Furan (TCDD/TCDF) ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction; 40 days after extraction

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 11 of 11
	Revision 3	Effective Date 02/04

**ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES,
AND HOLDING TIMES
PAGE THREE**

- (1) Polyethylene (P): generally 500 ml or Glass (G): generally 1L.
- (2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
- (3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).
- (4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.
- (5) Should only be used in the presence of residual chlorine.
- (6) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
- (7) Samples should be filtered immediately on site before adding preservative for dissolved metals.
- (8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
- (9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
- (10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
- (11) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re: the analysis of benzidine).
- (12) If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.
- (13) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
- (14) For the analysis of diphenylnitrosamine, add 0.008% Na₂S₂O₃ and adjust pH to 7-10 with NaOH within 24 hours of sampling.
- (15) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% Na₂S₂O₃.



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number	SA-6.3	Page	1 of 12
Effective Date	09/03	Revision	2
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Subject

FIELD DOCUMENTATION

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE.....	2
2.0 SCOPE.....	2
3.0 GLOSSARY	2
4.0 RESPONSIBILITIES	2
5.0 PROCEDURES	2
5.1 SITE LOGBOOK	2
5.1.1 General.....	2
5.1.2 Photographs	3
5.2 FIELD NOTEBOOKS	3
5.3 FIELD FORMS	4
5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results..	4
5.3.2 Hydrogeological and Geotechnical Forms	5
5.3.3 Equipment Calibration and Maintenance Form	6
5.4 FIELD REPORTS.....	6
5.4.1 Daily Activities Report.....	6
5.4.2 Weekly Status Reports.....	7
6.0 LISTING OF TETRA TECH NUS FIELD FORMS FOUND ON THE TTNUS INTRANET SITE. HTTP://INTRANET.TTNUS.COM CLICK ON FIELD LOG SHEETS.....	7

ATTACHMENTS

A	TYPICAL SITE LOGBOOK ENTRY	9
B	SAMPLE LABEL.....	10
C	CHAIN-OF-CUSTODY RECORD FORM.....	11
D	CHAIN-OF-CUSTODY SEAL	12

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 2 of 12
	Revision 2	Effective Date 09/03

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting Tetra Tech NUS field activities.

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Tetra Tech NUS field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

3.0 GLOSSARY

None

4.0 RESPONSIBILITIES

Project Manager (PM) - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of field work.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

5.0 PROCEDURES

5.1 Site Logbook

5.1.1 General

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded or referenced (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Time and date of H&S training
- Arrival/departure of equipment
- Time and date of equipment calibration
- Start and/or completion of borehole, trench, monitoring well installation, etc.
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 3 of 12
	Revision 2	Effective Date 09/03

that onsite activities take place which involve Tetra Tech NUS or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

The following information must be recorded on the cover of each site logbook:

- Project name
- Tetra Tech NUS project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the field notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the entry shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook/notebook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook/notebook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook/notebook. If possible, such techniques shall be avoided, since they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend upon the subject matter, type of camera (digital or film), and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook/notebook descriptions. The site photographs and associated negatives and/or digitally saved images to compact disks must be docketed into the project's central file.

5.2 Field Notebooks

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 4 of 12
	Revision 2	Effective Date 09/03

5.3 **Field Forms**

All Tetra Tech NUS field forms (see list in Section 6.0 of this SOP) can be found on the company's intranet site (<http://intranet.ttnus.com>) under Field Log Sheets. Forms may be altered or revised for project-specific needs contingent upon client approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

5.3.1 **Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results**

5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. The data recorded on these sheets are useful in describing the sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source electronically generated in-house, or are supplied from the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One carbonless copy of the completed COC form is retained by the field crew, one copy is sent to the Project Manager (or designee), while the original is sent to the laboratory. The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the cooler containing vials for VOC analysis or the cooler with the air bill attached. The air bill should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment C. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Tetra Tech NUS Project Manager). The COC form is signed and copied. The laboratory will retain the copy while the original becomes part of the samples' corresponding analytical data package.

5.3.1.4 Chain-of-Custody Seal

Attachment D is an example of a custody seal. The Custody seal is an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. The COC seals are signed and dated by the sampler(s) and affixed across the lid and body of each cooler (front and back) containing environmental samples (see SOP SA-6.1). COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 5 of 12
	Revision 2	Effective Date 09/03

5.3.1.5 Geochemical Parameters Log Sheets

Field Analytical Log Sheets are used to record geochemical and/or natural attenuation field test results.

5.3.2 **Hydrogeological and Geotechnical Forms**

5.3.2.1 Groundwater Level Measurement Sheet

A Groundwater Level Measurement Sheet must be filled out for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. The Pumping Test Data Sheet facilitates this task by standardizing the data collection format for the pumping well and observation wells, and allowing the time interval for collection to be laid out in advance.

5.3.2.3 Packer Test Report Form

A Packer Test Report Form must be completed for each well upon which a packer test is conducted.

5.3.2.4 Boring Log

During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring, or Boring Log is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a PID or FID), these readings must be entered on the boring log at the appropriate depth. The "Remarks" column can be used to subsequently enter the laboratory sample number, the concentration of key analytical results, or other pertinent information. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

A Monitoring Well Construction Details Form must be completed for every monitoring well, piezometer, or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation, or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock, stick-up or flush mount), different forms are used.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log must be filled out by the responsible field geologist or sampling technician.

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 6 of 12
	Revision 2	Effective Date 09/03

5.3.2.7 Miscellaneous Monitoring Well Forms

Monitoring Well Materials Certificate of Conformance should be used as the project directs to document all materials utilized during each monitoring well installation.

The Monitoring Well Development Record should be used as the project directs to document all well development activities.

5.3.2.8 Miscellaneous Field Forms - QA and Checklists

Container Sample and Inspection Sheet should be used as the project directs each time a container (drum, tank, etc.) is sampled and/or inspected.

QA Sample Log Sheet should be used at the project directs each time a QA sample is collected, such as Rinsate Blank, Source Blank, etc.

Field Task Modification Request (FTMR) will be prepared for all deviations from the project planning documents. The FOL is responsible for initiating the FTMRs. Copies of all FTMRs will be maintained with the onsite planning documents and originals will be placed in the final evidence file.

The Field Project Daily Activities Check List and Field Project Pre-Mobilization Checklist should be used during both the planning and field effort to assure that all necessary tasks are planned for and completed. These two forms are not a requirement but a useful tool for most field work.

5.3.3 **Equipment Calibration and Maintenance Form**

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used or in accordance with the manufacturer's recommendations.

5.4 Field Reports

The primary means of recording onsite activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation, but are not easily useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

5.4.1 **Daily Activities Report**

To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 7 of 12
	Revision 2	Effective Date 09/03

5.4.1.1 Description

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors. The DAR form can be found on the TtNUS intranet site.

5.4.1.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

5.4.1.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

5.4.2 **Weekly Status Reports**

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

It should be noted that in addition to summaries described herein, other summary reports may also be contractually required.

All Tetra Tech NUS field forms can be found on the company's intranet site at <http://intranet.ttnus.com> under Field Log Sheets.

6.0 **LISTING OF TETRA TECH NUS FIELD FORMS FOUND ON THE TTNUS INTRANET SITE. HTTP://INTRANET.TTNUS.COM CLICK ON FIELD LOG SHEETS**

Groundwater Sample Log Sheet
Surface Water Sample Log Sheet
Soil/Sediment Sample Log Sheet
Container Sample and Inspection Sheet
Geochemical Parameters (Natural Attenuation)
Groundwater Level Measurement Sheet
Pumping Test Data Sheet
Packer Test Report Form
Boring Log
Monitoring Well Construction Bedrock Flush Mount
Monitoring Well Construction Bedrock Open Hole
Monitoring Well Construction Bedrock Stick Up
Monitoring Well Construction Confining Layer
Monitoring Well Construction Overburden Flush Mount
Monitoring Well Construction Overburden Stick Up
Test Pit Log
Monitoring Well Materials Certificate of Conformance
Monitoring Well Development Record

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 8 of 12
	Revision 2	Effective Date 09/03

Daily Activities Record
 Field Task Modification Request
 Hydraulic Conductivity Test Data Sheet
 Low Flow Purge Data Sheet
 QA Sample Log Sheet
 Equipment Calibration Log
 Field Project Daily Activities Checklist
 Field Project Pre-Mobilization Checklist

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 9 of 12
	Revision 2	Effective Date 09/03

**ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY**

START TIME: _____ DATE: _____

SITE LEADER: _____

PERSONNEL: _____

TtNUS

DRILLER

SITE VISITORS

WEATHER: Clear, 68°F, 2-5 mph wind from SE


ACTIVITIES:

1. Steam jenny and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was _____. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well _____.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _____.
4. Well _____ drilled. Rig geologist was _____. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit _____.
8. Test pit _____ dug with cuttings placed in dump truck. Rig geologist was _____. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ____ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

Field Operations Leader

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 10 of 12
	Revision 2	Effective Date 09/03

ATTACHMENT B

 Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090		Project:	
		Site:	
		Location:	
Sample No:		Matrix:	
Date:	Time:	Preserve:	
Analysis:			
Sampled by:		Laboratory:	

Subject	Number	Page
	SA-6.3	11 of 12
FIELD DOCUMENTATION		
Revision	Effective Date	
2	09/03	

ATTACHMENT C

[illegible]

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 12 of 12
	Revision 2	Effective Date 09/03

ATTACHMENT D

CHAIN-OF-CUSTODY SEAL

Signature <hr/>		CUSTODY SEAL
Date <hr/>		Date <hr/>
CUSTODY SEAL		Signature <hr/>



STANDARD OPERATING PROCEDURES

Number SA-7.1	Page 1 of 16
Effective Date 01/28/2009	Revision 6
Applicability Tetra Tech NUS, Inc.	
Prepared Earth Sciences Department	
Approved Tom Johnston <i>T.E. Johnston</i>	

Subject DECONTAMINATION OF FIELD EQUIPMENT

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 PURPOSE.....	2
2.0 SCOPE AND APPLICABILITY	2
3.0 GLOSSARY	2
4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS	3
5.0 HEALTH AND SAFETY	3
6.0 EQUIPMENT LIST	3
7.0 PROCEDURES.....	4
7.1 Decontamination Pad Design/Construction Considerations	5
7.1.1 Temporary Decontamination Pads	5
7.1.2 Decontamination Activities at Drill Rigs/DPT Units	7
7.1.3 Decontamination Activities at Remote Sample Locations	7
7.2 Equipment Decontamination Procedures	7
7.2.1 Monitoring Well Sampling Equipment.....	7
7.2.2 Downhole Drilling Equipment	9
7.2.3 Soil/Sediment Sampling Equipment	11
7.3 Contact Waste/Materials	11
7.3.1 Investigation-Derived Wastes - Decontamination Wash Waters and Sediments	12
7.4 Decontamination Evaluation	13

ATTACHMENTS

A	INVESTIGATION-DERIVED WASTE LABEL.....	15
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Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	2 of 16
		Revision	6	Effective Date	01/28/2009

1.0 PURPOSE

Decontamination is the process of removing and/or neutralizing site contaminants that have contacted and/or accumulated on equipment. The purpose of this Standard Operating Procedure (SOP) is to protect site personnel, the general public, and the environment while preserving or maintaining sample integrity. It is further intended through this procedure to describe the steps necessary for proper decontamination of drilling equipment, earth-moving equipment, chemical sampling equipment and field operation and analytical equipment.

2.0 SCOPE AND APPLICABILITY

This procedure applies to all equipment used to provide access to/acquire environmental samples that may have become contaminated through direct contact with contaminated media including air, water, and soil. This equipment includes drilling and heavy equipment and chemical sampling and field analytical equipment. Where technologically and economically feasible, single-use sealed disposable equipment will be employed to minimize the potential for cross-contamination. This SOP also provides general reference information on the control of contaminated materials.

Decontamination methods and equipment requirements may differ from one project to another. General equipment items are specified in Section 6.0, but project-specific equipment must be obtained to address the project-specific decontamination procedures presented in Section 7.0 and applicable subsections.

3.0 GLOSSARY

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

Decontamination Solution - A solution selected/identified in the Health and Safety Plan or Project-Specific Quality Assurance Plan. The solution is selected and employed as directed by the project chemist/health and safety professional.

Deionized Water (DI) - Tap water that has been treated by passing through a standard deionizing resin column. This water may also pass through additional filtering media to attain various levels of analyte-free status. The DI water should meet College of American Pathologists (CAP) and National Committee for Clinical Laboratory Standards (NCCLS) specifications for reagent-grade Type I water.

Potable Water - Tap water from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Pressure Washing - Process employing a high-pressure pump and nozzle configuration to create a high-pressure spray of potable water. High-pressure spray is employed to remove solids from equipment.

Solvent – A liquid in which solid chemicals or other liquids are dissolved. The solvent of choice is pesticide-grade isopropanol. Use of other solvents (methanol, acetone, or hexane) may be required for particular projects or for a particular purpose (e.g., removal of concentrated waste) and must be justified in the project planning documents. For example, it may be necessary to use hexane when analyzing for trace levels of pesticides, PCBs, or fuels. In addition, because many of these solvents are not miscible in water, the equipment should be air dried prior to use. Solvents should not be used on PVC equipment or well construction materials.

Steam Pressure Washing - A cleaning method employing a high-pressure spray of heated potable water to remove various organic/inorganic chemicals from equipment.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	3 of 16
		Revision	6	Effective Date	01/28/2009

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Project Manager - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

Decontamination Personnel - Individuals assigned the task of decontamination. It is the responsibility of these individuals to understand the use and application of the decontamination process and solutions as well as the monitoring of that process to ensure that it is working properly. This is accomplished through visual evaluation, monitoring instrument scanning of decontaminated items, and/or through the collection of rinsate blanks to verify contaminant removal.

Field Operations Leader (FOL) - Responsible for the implementation of project-specific planning documents. This includes on-site verification that all field activities are performed in compliance with approved SOPs or as otherwise dictated by the approved project plan(s). The FOL is also responsible for the completion and accuracy of all field documentation.

Site Safety Officer (SSO) - Exercises shared responsibility with the FOL concerning decontamination effectiveness. All equipment arriving on site (as part of the equipment inspection), leaving the site, and moving between locations is required to go through a decontamination evaluation. This is accomplished through visual examination and/or instrument screening to determine the effectiveness of the decontamination process. Improper or incomplete decontamination is sufficient to restrict equipment from entering the site, exiting the site, or moving to a new location on the site until the objectives are successfully completed.

General personnel qualifications for decontamination activities include the following:

- Occupational Safety and Health Administration (OSHA) 40-hour and applicable refresher training.
- Capability of performing field work under the expected physical and environmental (i.e., weather) conditions.
- Familiarity with appropriate decontamination procedures.

5.0 HEALTH AND SAFETY

In addition to the health and safety issues and reminders specified in subsections of this SOP, the following considerations and requirements must be observed as SOPs for field equipment decontamination activities:

- If any solvents or hazardous chemicals (e.g., isopropyl alcohol) are to be used in equipment decontamination activities, the FOL must first obtain the manufacturer's/supplier's Material Safety Data Sheet (MSDS) and assure that it is reviewed by all users (prior to its use), added to the site Hazardous Chemical Inventory, and maintained on site as part of the project Hazard Communication Program.
- Review and observe specific health and safety requirements (e.g., personal protective equipment [PPE]) specified in the project-specific health and safety plan for this activity.

6.0 EQUIPMENT LIST

- Wood for decontamination pad construction, when applicable (see Section 7.1).

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	4 of 16
		Revision	6	Effective Date	01/28/2009

- Tools for constructing decontamination pad frame, when applicable (see Section 7.1).
- Visqueen sheeting or comparable material to cover decontamination pad frame, when applicable (see Section 7.1).
- Wash/drying racks for auger flights and drill/drive rods, when applicable (see Section 7.2).
- PPE as specified in the project health and safety plan.
- Soap and water for washing and rinsing.
- Deionized water for final rinsing.
- Solvents (e.g., pesticide-grade isopropanol) for rinsing (see applicable portions of Section 7.2).
- Tubs, buckets, etc. for containerizing rinse water (see applicable portions of Section 7.2).
- Sample bottles for collecting rinsate blanks (see Section 7.2).
- Calibrated photoionization detector (PID) or flame ionization detector (FID) to monitor decontaminated equipment for organic vapors generated through the existence of residual contamination or the presence of decontamination solvent remaining after the piece was rinsed.
- Aluminum foil or clear clean plastic bag for covering cleaned equipment (see applicable portions of Section 7.2).
- Paper towels or cloths for wiping.
- Brushes, scrapers, or other hand tools useful for removing solid materials from equipment.
- Clear plastic wrap for covering or wrapping large decontaminated equipment items (see Section 7.2.2).
- Drum-moving equipment for moving filled waste drums (optional) (see Section 7.3).
- Drum labels for waste drums (see Attachment A).

7.0 PROCEDURES

The process of decontamination is accomplished through the removal of contaminants, neutralization of contaminants, or isolation of contaminants. To accomplish this activity, preparation is required including site preparation, equipment selection, and evaluation of the decontamination requirements and processes. Site contaminant types, concentrations, and media types are primary drivers in the selection of the types of decontamination and where it will be conducted. For purposes of this SOP, discussion is limited to decontamination procedures for general environmental investigations.

Decontamination processes will be performed at the location(s) specified in project-specific planning documents. Typical decontamination locations include the following:

- Temporary decontamination pads/facilities
- Sample locations
- Centralized decontamination pad/facilities

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	5 of 16
		Revision	6	Effective Date	01/28/2009

- Combination of some or all of the above

The following discussion includes general considerations for the decontamination process. Specific construction and implementation procedures will be as specified in the project-specific planning documents and/or may be as dictated by site-specific conditions as long as the intent of the requirements in the planning documents is met. This intent is to contain any residual fluids and solids generated through the decontamination process.

7.1 Decontamination Pad Design/Construction Considerations

7.1.1 Temporary Decontamination Pads

Temporary decontamination pads may be constructed at satellite locations within the site area in support of temporary work areas. These structures are generally constructed to support the decontamination of heavy equipment such as drill rigs and earth-moving equipment but can be employed for smaller articles.

The purpose of the decontamination pad is to contain wash waters and potentially contaminated soil generated during decontamination procedures. Therefore, construction of these pads should take into account the following considerations:

- Site location – The decontamination site selected should be far enough from the work site to maximize decontamination effectiveness while minimizing travel distance. The location of the decontamination site shall be selected to provide, in the judgment of the FOL or FOL designee, compliance with as many of the following characteristics as practicable:
 - Well removed from pedestrian/vehicle thoroughfares.
 - Avoidance of areas where control/custody cannot be maintained.
 - Avoidance of areas where potential releases of contaminated media or decontamination fluids may be compounded through access to storm water transport systems, streams, or other potentially sensitive areas.
 - Avoidance of potentially contaminated areas.
 - Avoidance of areas too close to the ongoing operation, where cross-contamination may occur.

The selected decontamination site should include the following, where possible:

- Areas where potable water and electricity are provided.

Safety Reminder

When utilizing electrical power sources, either hard-wired or portable-generated sources, ensure that:

- All power is routed through a Ground Fault Circuit Interrupter (GFCI).
- All power cords are in good condition (no physical damage), rated for the intended energy load, and designated for outdoor use.

In situations where accomplishing these elements is not possible, it will be necessary to implement a site electrical grounding program.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	6 of 16
		Revision	6	Effective Date	01/28/2009

- Areas where support activities such as removing decontamination waters soil and sediment are possible without entering an active exclusion zone.
- Areas that offer sufficient size to carry out the specific decontamination sequence.
- Decontamination pad (decon pad) – The decon pad shall be constructed to meet the following characteristics:
 - Size – The size of the pad should be sufficient to accept the equipment to be decontaminated as well as permitting free movement around the equipment by the personnel conducting the decontamination. The size should permit these movements utilizing pressure/steam washer wands and hoses and minimizing splash due to work in close quarters.
 - Slope – An adequate slope will be constructed to permit the collection of water and potentially contaminated soil within a trough or sump constructed at one end. The collection point for wash waters should be of adequate distance that the decontamination workers do not have to walk through the wash waters while completing their tasks. Because the pad will be sloped, place a light coating of sand over the plastic to minimize potential slips and falls. See the text about liners below.
 - Sidewalls – The sidewalls shall be at least 6 inches in height (or as high as possible if 6 inches is not achievable) to provide adequate containment for wash waters and soil. If splash represents a potential problem, splash guards should be constructed to control overspray. Sidewalls may be constructed of wood, inflatables, sand bags, etc. to permit containment. Splash guards are typically wood frames with Visqueen coverings to control overspray.
 - Liner – Depending on the types of equipment and decontamination method to be used, the liner should be of sufficient thickness to provide a puncture-resistant barrier between the decontamination operation and the unprotected environment. Care should be taken to examine the surface area prior to placing the liner to remove sharp articles (sticks, stones, debris) that could puncture the liner. Liners are intended to form an impermeable barrier. The thickness may vary from a minimum recommended thickness of 10 mil to 30 mil. The desired thickness may be achieved through layering materials of lighter construction. It should be noted that various materials (rubber, polyethylene sheeting) become slippery when wet. To minimize this potential hazard associated with a sloped liner, a light coating of sand shall be applied to provide traction as necessary.
 - Wash/drying racks – Auger flights, drill/drive rods, and similar equipment require racks positioned off of the ground to permit these articles to be washed, drained, and dried while secured from falling during this process.

For decontamination of direct-push technology (DPT) equipment, the pad may be as simple as a mortar tub containing buckets of soapy water for washing and an empty bucket to capture rinse waters. Decontamination may be conducted at the rear of the rig to permit rapid tool exchange.

- Maintenance – Maintain the decontamination area by:
 - Periodically clearing the work area of standing water, soil, and debris, and coiling hoses to aid in eliminating slip, trip, and fall hazards. In addition, these articles will reduce potential backsplash and cross-contamination.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number SA-7.1	Page 7 of 16
		Revision 6	Effective Date 01/28/2009

- Regularly changing the decontamination fluids to ensure proper cleaning and prevent cross-contamination.
- PPE – Periodically evaluate the condition of, and maintain the decontamination equipment, including regular cleaning of face shields and safety glasses. This is critical to ensuring the safety of decontamination personnel and the integrity of the decontamination process, and it will ensure that equipment is functioning properly.

7.1.2 Decontamination Activities at Drill Rigs/DPT Units

During subsurface sampling activities including drilling and DPT activities, decontamination of drive rods, Macro Core Samplers, split spoons, etc. is typically conducted at an area adjacent to the operation. Decontamination is generally accomplished using a soap/water wash and rinse utilizing buckets and brushes. This area requires sufficient preparation to accomplish the decontamination objectives.

Buckets shall be placed within mortar tubs or similar secondary containment tubs to prevent splash and spills from reaching unprotected environmental media. Drying racks shall be employed as directed for temporary pads to permit parts to dry and be evaluated prior to use/reuse. Methodology regarding this activity is provided in Section 7.2.

7.1.3 Decontamination Activities at Remote Sample Locations

When sampling at remote locations, sampling equipment such as trowels and pumps/tubing should be evacuated of potentially contaminated media to the extent possible. This equipment should be wrapped in plastic for transport to the temporary/centralized decontamination location for final cleaning and disposition. Flushing and cleaning of single-use equipment such as disposable trowels, tubing, and surgeon's gloves may allow disposal of this equipment after visible soil and water remnants have been removed.

7.2 Equipment Decontamination Procedures

The following represents procedures to be employed for the decontamination of equipment that may have contacted and/or accumulated contamination through site investigation activities.

7.2.1 Monitoring Well Sampling Equipment

7.2.1.1 Groundwater sampling equipment – This includes pumps inserted into monitoring wells such as bladder pumps, Whale pumps, and Redi-Flo pumps and reusable bailers, etc.

1. Evacuate to the extent possible, any purge water within the pump/bailer.
2. Scrub using soap and water and/or steam clean the outside of the pump/bailer and, if applicable, the pump tubing.
3. Insert the pump and tubing/bailer into a clean container of soapy water. Pump/run a sufficient amount of soapy water through the pump/bailer to flush out any residual well water. After the pump is flushed, circulate soapy water through the pump to ensure that the internal components are thoroughly flushed.
4. Remove the pump and tubing/bailer from the container
5. Rinse external pump components using tap water.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	8 of 16
		Revision	6	Effective Date	01/28/2009

6. Insert the pump and tubing/bailer into a clean container of tap water. Pump/run a sufficient amount of tap water through the pump/bailer to evacuate all of the soapy water (until clear).

CAUTION

Do not rinse PE, PVC, and associated tubing with solvents –
Use the procedures defined in the project-specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 7 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.

7. If groundwater contains or is suspected to contain oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse the equipment to be cleaned with pesticide-grade isopropanol.
8. Pass deionized water through the hose to flush out the tap water and solvent residue as applicable.
9. Drain residual deionized water to the extent possible.
10. Allow components of the equipment to air dry.
11. For bladder pumps, disassemble the pump and wash the internal components with soap and water, then rinse with tap water, isopropanol, and deionized water and allow to dry. After the parts are dry, conduct a visual inspection and a monitoring instrument scan to ensure that potential contaminants and all decontamination solvent have been removed. Collect a rinsate blank in accordance with the project-specific planning documents to ensure that the decontamination process is functioning as intended. The typical frequency of collection for rinsate blanks is 1 per 20 field samples. In addition, wipe samples or field tests such as UV light may be used.
12. Wrap pump/bailer in aluminum foil or a clear clean plastic bag for storage.

SAFETY REMINDER

Remember when handling powered equipment to disconnect the power source and render the equipment to a zero energy state (both potential and kinetic) before opening valves, disconnecting lines, etc.

7.2.1.2 Electronic Water Level Indicators/Sounders/Tapes

During water level measurements, rinsing the extracted tape and probe with deionized water and wiping the surface of the extracted tape between locations is acceptable. However, periodic full decontamination should be conducted as follows:

1. Wash with soap and water
2. Rinse with tap water
3. Rinse with deionized water

NOTE

In situations where oil, grease, free product, other hard to remove materials are encountered, probes and exposed tapes should be washed in hot soapy water. If probes or tapes cannot be satisfactorily decontaminated (they are still stained, discolored, etc.), they should be removed from service.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	9 of 16
		Revision	6	Effective Date	01/28/2009

7.2.1.3 Miscellaneous Equipment

Miscellaneous equipment including analytical equipment (water quality testing equipment) shall be cleaned per manufacturers' instructions. This generally includes wiping the sensor housing and rinsing with tap and deionized water.

Coolers/shipping containers employed to ship samples are received from the laboratory in a variety of conditions including marginal to extremely poor. Coolers shall be evaluated prior to use for the following:

- Structural integrity – Coolers missing handles or having breaks in the outer housing should be removed and not used. Notify the laboratory that the risk of shipping samples in the cooler(s) provided is too great and request a replacement unit.
- Cleanliness – As per protocol, only volatile organic samples are accompanied by a trip blank. If a cooler's cleanliness is in question (visibly dirty/stained) or if there are noticeable odors, the cooler should be decontaminated prior to use as follows:
 1. Wash with soap and water
 2. Rinse with tap water
 3. Dry

If these measures fail to clean the cooler to an acceptable level, remove the unit from use as a shipping container and ask the cooler provider (e.g., the analytical laboratory) to provide a replacement unit.

7.2.2 **Downhole Drilling Equipment**

This includes any portion of the drill rig that is over the borehole, including auger flights, drill stems, rods, and associated tooling that would extend over the borehole. The following procedure is to be employed prior to initiating the drilling/sampling activity, then between locations:

CAUTION

Exercise care when using scrapers to remove soil and debris from downhole drilling equipment. Inadvertent slips of scrapers have resulted in cuts, scrapes, and injured knuckles, so use scrapers carefully when removing soil from these items.

1. Remove loose soil using shovels, scrapers, etc.
2. Through a combination of scrubbing using soap and water and/or steam cleaning or pressure washing, remove visible dirt/soil from the equipment being decontaminated.

CAUTION

In Step 3, do not rinse PE, PVC, and associated tubing with solvents. The appropriate procedures should be defined within the project-specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 4 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.

3. Rinse the equipment with tap water, where applicable (steam cleaning and pressure washing incorporate rinsing as part of the process).

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number SA-7.1	Page 10 of 16
		Revision 6	Effective Date 01/28/2009

4. If the equipment has directly or indirectly contacted contaminated sample media and is known or suspected of being contaminated with oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol
5. To the extent possible, allow components to air dry.
6. If the decontaminated equipment is to be used immediately after decontamination, screen it with a calibrated photoionization detector (PID)/flame ionization detector (FID) to ensure that all contaminants and possible decontamination solvents (if they were used) have been adequately removed.
7. Wrap or cover equipment in clear plastic until it is time to be used.

SAFETY REMINDER

Even when equipment is disconnected from power sources, dangers such as the following may persist:

Falls - An auger flight standing on its end may fall and injure someone. Secure all loose articles to prevent heavy articles from falling onto people or equipment.

Burns - Steam cleaner water is heated to more than 212 °F and exhibits thermal energy that can cause burns. Prevent contact of skin with hot water or surfaces.

High water pressure - Pressure washer discharge can have 2,000 to 4,000 psi of water pressure. Water under this amount of pressure can rupture skin and other human tissues. Water at 4,000 psi exiting a 0° tip can be dangerous because of its relatively high cutting power. The exit velocity and cutting power of the water are reduced when exiting a 40° fan tip, but damage to soft tissues is still possible.

In general, follow the rules below to avoid injury, equipment damage, or incomplete decontamination:

1. Read the operating manual and follow the manufacturers' recommended safety practices before operating pressure washers and steam cleaners.
2. Never point the pressure washer or steam cleaner at another person or use to clean your boots or other parts of your body. Water lacerations and burns may appear to be minor at first but can be life threatening. Do not attempt to hold small parts in your hand while washing them with high-temperature or high-pressure water.
3. Always wear PPE as specified in the HASP such as:
 - Hard hat, safety glasses, splash shield, impermeable apron or splash suit, and hearing protection. Remember that excessive noise is a hazard when operating gas-powered engines and electrically driven pressure washers. PPE will be identified in your project specific planning documents.
4. Inspect each device before use. An inspection checklist will be provided in the project-specific planning documents. If it is a rented device, safety measures are typically provided by the vendor. In all cases, if you are not familiar with the operation of a pressure washer/steam cleaner, do not operate it until you obtain and thoroughly review operating instructions and recommended safety practices.
5. Do not modify equipment unless the manufacturer has approved the modifications.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	11 of 16
		Revision	6	Effective Date	01/28/2009

7.2.3 Soil/Sediment Sampling Equipment

This section applies to soil sampling equipment including but not limited to hand augers, stainless steel trowels/spoons, bowls, dredges, scoops, split spoons, Macro Core samplers, etc.

1. Remove all loose soil from the equipment through manual means.
2. Through a combination of scrubbing using soap and water and/or steam cleaning or pressure washing, remove visible dirt/soil from the equipment.
3. Rinse the equipment with tap water.

CAUTION

Do not rinse PE, PVC, and associated tubing with solvents. The appropriate procedures should be defined within the project-specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 4 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.

4. If the equipment is contaminated or suspected to be contaminated with oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse the equipment with pesticide-grade isopropanol.
5. Rinse the equipment with deionized water.
6. To the extent possible, allow components to air dry.
7. If the equipment is to be used immediately after decontamination, screen it with a calibrated PID/FID to ensure that all solvents (if they were used) and trace contaminants have been adequately removed.
8. After the equipment has dried, wrap it in aluminum foil for storage until use.

Dredges employed in sediment sampling are typically decontaminated as follows:

- Remove the sediment sample from the sampling device
- If sufficient associated surface water is available at the sampling site, place the dredge in the water and flush to remove visible sediment.
- Extract the dredge and wash it in soap and water per the project-specific planning documents.

CAUTION

When handling dredges, the primary safety concern is trapping fingers or extremities in the larger dredge samplers within the jaws or pinch points of the mechanical jaws. Keep hands, fingers, and extremities away from these pinch and compression points. Either handle the device by the rope or preferably lock the jaws in place to control the potential for closing during maintenance and/or cleaning.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	12 of 16
		Revision	6	Effective Date	01/28/2009

7.3 **Contact Waste/Materials**

During the course of field investigations, disposable/single-use equipment becomes contaminated. These items include tubing, trowels, PPE (gloves, overboots, splash suits, etc.), and broken sample containers.

With the exception of the broken glass, single-use articles should be cleaned (washed and rinsed) of visible materials and disposed as normal refuse. The exception to this rule is that extremely soiled materials that cannot be cleaned shall be containerized for disposal in accordance with applicable federal, state, and local regulations.

7.3.1 **Investigation-Derived Wastes - Decontamination Wash Waters and Sediments**

NOTE

Requirements for waste storage may differ from one facility to the next. Facility-specific directions for waste storage areas will be provided in project-specific documents, or separate direction will be provided by the Project Manager.

1. Assume that all investigation-derived waste (IDW) generated from decontamination activities contains the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. Waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.
2. Where possible, use filtering systems to extend the use of water within a closed system wash unit to recycle water and to reduce possible waste amounts.

NOTE

Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility.

3. Label waste storage containers appropriately labeled (see Attachment A).
4. Ensure that the IDW storage area is configured to meet the following specifications to permit access to the containers and to conduct spill/leak monitoring, sampling, and extraction when the disposal route is determined:
 - Enclose areas accessible by the general public using construction fencing and signs.
 - Stored materials in 55-gallon drums on pallets with four (or fewer) drums per pallet.
 - Maintain the retaining bolt and label on the outside of storage containers where readily visible.
 - Provide at least 4 feet of room between each row of pallets to allow access to containers for sampling, drum removal, and spill response.
 - As directed in project-specific planning documents, maintain an IDW Inventory List and provide the list to the site Point of Contact at the termination of each shift.
 - Maintain spill response equipment at the IDW storage area in case it is required for immediate access.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	13 of 16
		Revision	6	Effective Date	01/28/2009

- Where possible, use equipment for moving containers. Where not possible, obtain help to manipulate containers.

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	14 of 16
		Revision	6	Effective Date	01/28/2009

CAUTION

Each container of water can weigh up to 490 pounds. Each 55-gallon drum of wet soil can weigh more than 750 pounds. Fill drums and temporary containers to 80 percent capacity to minimize spill and handling difficulties. Use drum carts to move filled drums.

See safe lifting techniques provided in Section 4.4 of the Tetra Tech NUS, Inc. Health and Safety Guidance Manual.

When placing drums, keep your fingers out of pinch and smash points such as between the drums. In some cases such as well development and/or purge water, you can place the drums to be filled on the pallet and transport materials in smaller easier to handle containers.

7.4 **Decontamination Evaluation**

Upon decontamination of equipment, determine the effectiveness of the decontamination process in the following manner:

- Visual evaluation – A visual evaluation will be conducted to ensure the removal of particulate matter. This shall be done to ensure that the washing/rinsing process is working as intended.
- Instrument Screening – A properly calibrated PID/FID should be used to evaluate the presence of site contaminants and solvents used in the cleaning process. The air intake of the instrument shall be passed over the article to be evaluated. Avoid placing the instrument probe into residual waters. A PID/FID reading greater than the daily established background level requires a repeat of the decontamination process, followed by rescreening with the PID/FID. This sequence must be repeated until no instrument readings greater than the daily established background level are observed. It should be noted that the instrument scan is only viable if the contaminants are detectable within the instrument's capabilities.

NOTE

When required by project-specific planning documents, collection of rinsate blanks (see next step) shall be completed without exception unless approval to not collect these samples is obtained from the Project Manager.

- Collection of Rinsate Blanks – It is recommended that rinsate samples be collected to:
 - Evaluate the decontamination procedure representing different equipment applications (pumps versus drilling equipment) and different decontamination applications.
 - Single-use disposable equipment – The number of samples should represent different types of equipment as well as different lot numbers of single-use articles.
 - The collection and the frequency of collection of rinsate samples are as follows unless specified differently in the project-specific planning documents:
 - Per decontamination method
 - Per disposable article/batch number of disposable articles

Subject	DECONTAMINATION OF FIELD EQUIPMENT	Number	SA-7.1	Page	15 of 16
		Revision	6	Effective Date	01/28/2009

NOTE

It is recommended that an initial rinsate sample be collected early in the project to ensure that the decontamination process is functioning properly and to avoid using a contaminated batch of single-use articles. It is recommended that a follow-up sample be collected later during the execution of the project to ensure that those conditions do not change.

Rinsate samples collection may be driven by types of and/or levels of contaminant. Difficult to remove contaminants, oils/greases, some PAHs/PCBs, etc. may also support the collection of additional rinsates due to the obvious challenges to the decontamination process. This is a field consideration to be determined by the FOL.



STANDARD OPERATING PROCEDURES

Number

SA-7.1

Page

16 of 16

Effective Date

01/28/2009

Revision

6

Applicability

Tetra Tech NUS, Inc.

Prepared

Earth Sciences Department

Subject DECONTAMINATION OF FIELD EQUIPMENT

Approved

Tom Johnston

Attachment A iDW Label

INVESTIGATION DERIVED WASTE

GENERATOR INFORMATION:

SITE _____ JOB NO. _____

LOCATION _____

DATE _____

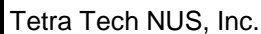
DRUM# _____

CONTENTS _____

VOLUME _____

CONTACT _____

EMERGENCY PHONE NUMBER _____



Page ____ of ____

BORING No.: _____
DATE: _____
GEOLOGIST: _____
DRILLER: _____

Converted to Well:	Yes	No	Well I.D. #:
--------------------	-----	----	--------------



Tetra Tech NUS, Inc.

CONTAINER SAMPLE & INSPECTION SHEET

Page _____ of _____

Project Site Name: _____
 Project Number: _____
 Site Identification: _____
 Container Number(s): _____
 Sample Type: ☐ Grab
 ☐ Composite

Sample ID No. _____
 Sampled By: _____
 C.O.C. No.: _____
 Concentration: ☐ High
 ☐ Medium
 ☐ Low

CONTAINER SOURCE		CONTAINER DESCRIPTION																					
DRUM: <input type="checkbox"/> Bung Top <input type="checkbox"/> Lever Lock <input type="checkbox"/> Bolted Ring <input type="checkbox"/> Other _____		COLOR: _____ CONDITION: _____																					
TANK: <input type="checkbox"/> Plastic <input type="checkbox"/> Metal <input type="checkbox"/> Other _____		MARKINGS: _____ VOL. OF CONTENTS: _____																					
OTHER: _____		OTHER: _____																					
CONTAINER DISPOSITION		CONTENTS DESCRIPTION																					
SAMPLED: _____ OPENED BUT NOT SAMPLED: Reason _____ _____ NOT OPENED: Reason _____ _____		SINGLE PHASED: _____ _____ MULTIPHASE : <table border="1"> <thead> <tr> <th></th> <th>Layer 1</th> <th>Layer 2</th> <th>Layer 3</th> </tr> </thead> <tbody> <tr> <td>Phase (Sol. or Liq.)</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>Color</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>Viscosity</td> <td>L, M or H</td> <td>L, M or H</td> <td>L, M or H</td> </tr> <tr> <td>% of Total Volume</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table>			Layer 1	Layer 2	Layer 3	Phase (Sol. or Liq.)	_____	_____	_____	Color	_____	_____	_____	Viscosity	L, M or H	L, M or H	L, M or H	% of Total Volume	_____	_____	_____
	Layer 1	Layer 2	Layer 3																				
Phase (Sol. or Liq.)	_____	_____	_____																				
Color	_____	_____	_____																				
Viscosity	L, M or H	L, M or H	L, M or H																				
% of Total Volume	_____	_____	_____																				
MONITOR READING:		SAMPLE and /or INSPECTION DATE & TIME:																					
		_____ HRS.																					
		METHOD: _____																					
SAMPLER(S) and / or INSPECTOR(S) SIGNATURE:		ANALYSIS:																					

Tetra Tech NUS, Inc.

PROJECT: _____
LOCATION: _____
PROJECT MANAGER: _____

JOB #: _____
DATE: _____
FOL: _____

DAILY ACTIVITIES CHECKLIST			
Startup Checklist			
Activity	Yes	No	N/A
Pertinent site activities/information entered into site logbook			
All onsite personnel listed in logbook			
Required medical information onsite for all workers (TtNUS and Subcontractors)			
Required MSDS's onsite			
Proper equipment calibrations performed (list equipment)			
1 _____			
2 _____			
3 _____			
4 _____			
Calibration logs filled out			
Tailgate H&S meeting held prior to beginning field activities			
Required work permits filled out/signed			
Required utility clearances obtained			
Required PPE onsite and in use			
Information required to be posted is in place (OSHA poster, hospital route, key phone numbers, etc.)			
Exit Checklist			
Activity	Yes	No	N/A
Logbooks completely and comprehensively filled out			
Field forms complete and accounted for/properly filed			
Samples properly packaged/shipped			
COCs faxed to appropriate in-house personnel			
All equipment accounted for, on charge if needed, and properly secured			
All personnel accounted for			
Arrangements made for upcoming work (permits, clearances, equipment, etc.)			
Site properly secured			

Note - not all items listed apply to every job, and some additional requirements may apply on a job-specific basis.



Tetra Tech NUS, Inc.

DAILY ACTIVITIES RECORD

PROJECT NAME:		PROJECT NUMBER:	
CLIENT:		LOCATION:	
DATE:		ARRIVAL TIME:	
Tt NUS PERSONNEL:		DEPARTURE TIME:	
CONTRACTOR:		DRILLER:	

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

COMMENTS:

APPROVED BY:

Tt NUS REPRESENTATIVE

DRILLER

DATE:

Tetra Tech NUS, Inc.

PROJECT: _____ LOCATION: _____
 JOB & CTO #: _____ MOBILIZATION DATE: _____
 PROJECT MANAGER: _____ RETURN DATE: _____

FIELD PROJECT DEMOBILIZATION CHECKLIST	
<div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">TRAVEL</div> <div style="margin-bottom: 5px;"> <input type="checkbox"/> Airline reservations <input type="checkbox"/> Hotel reservations/BOQs <input type="checkbox"/> Vehicle rental <input type="checkbox"/> Itinerary <input type="checkbox"/> Phone/pager number </div> <div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">DRILLING/DPT/SURVEY</div> <div style="margin-bottom: 5px;"> Subcontractor <input type="checkbox"/> POC phone #/address <input type="checkbox"/> Drill Specification RFP <input type="checkbox"/> Contact (time & place to meet) <input type="checkbox"/> Confirm subcontract w/ TtNUS Procurement <input type="checkbox"/> Health and Safety documentation for all personnel on site <input type="checkbox"/> Copy of Drillers license <input type="checkbox"/> Well / boring permits </div> <div style="margin-bottom: 5px;"> Utilities (2 weeks lead time) <input type="checkbox"/> Contact Site POC (Date: _____) <input type="checkbox"/> Contact Local "Call Before You Dig" <input type="checkbox"/> Utility Clearance Form </div> <div style="margin-bottom: 5px;"> Forms <input type="checkbox"/> Boring logs / Test Pit logs <input type="checkbox"/> Well construction / development forms <input type="checkbox"/> Daily activity forms <input type="checkbox"/> IDW inventory <input type="checkbox"/> IDW drum labels <input type="checkbox"/> Chemical Inventory <input type="checkbox"/> MSDS's </div> <div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">EQUIPMENT MOBILIZATION</div> <div style="margin-bottom: 5px;"> <input type="checkbox"/> Equipment Requisition form completed / equipment ordered <input type="checkbox"/> 3rd Party rental / misc. equipment ordered <input type="checkbox"/> Equipment calibration forms <input type="checkbox"/> Span / calibration gas and regulator </div> <div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">SAMPLING</div> <div style="margin-bottom: 5px;"> Forms <input type="checkbox"/> Sample log sheets <input type="checkbox"/> Low-flow purge data sheets <input type="checkbox"/> COC records <input type="checkbox"/> COC seals <input type="checkbox"/> Sample labels (from database group) </div> <div style="margin-bottom: 5px;"> Laboratory <input type="checkbox"/> POC address/phone# <input type="checkbox"/> Order bottles / preservatives <input type="checkbox"/> Shipping address, also check Sat. address <input type="checkbox"/> Bottle & preservation req'ts from lab <input type="checkbox"/> _____ </div>	<div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">MISCELLANEOUS</div> <div style="margin-bottom: 5px;"> Schedule <input type="checkbox"/> Plan field operations w/ Project manager </div> <div style="margin-bottom: 5px;"> Documents for Field Program <input type="checkbox"/> Logbook(s) <input type="checkbox"/> Field Sampling plan <input type="checkbox"/> Health & Safety plan <input type="checkbox"/> Maps <input type="checkbox"/> H & S Guidance Manual </div> <div style="margin-bottom: 5px;"> Authorization <input type="checkbox"/> Kick-off meeting held <input type="checkbox"/> Gov't rate letter <input type="checkbox"/> H&S/OSHA 40-hour certificate <input type="checkbox"/> 8-Hour Refresher Training Certificate <input type="checkbox"/> Medical Clearance Letter <input type="checkbox"/> Supervisory Training Certificate <input type="checkbox"/> Health & Safety Clearance Letter <input type="checkbox"/> Full-size OSHA Poster </div> <div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">HYDROGEOLOGY EQUIPMENT</div> <div style="margin-bottom: 5px;"> <input type="checkbox"/> Slug test/pumping test forms <input type="checkbox"/> Groundwater elevation data sheets <input type="checkbox"/> Graph paper <input type="checkbox"/> Data Logger/transducer/data cable <input type="checkbox"/> Existing well construction & water level data <input type="checkbox"/> M-Scope, slug </div> <div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">SHIPPING</div> <div style="margin-bottom: 5px;"> Forms <input type="checkbox"/> FedEx Airbills, local dropoff location & hours <input type="checkbox"/> FedEx Gov. Acct# (1771-8058-0) <input type="checkbox"/> Lab Shipping Labels <input type="checkbox"/> Warehouse Shipping Labels <input type="checkbox"/> Blank Labels </div> <div style="margin-bottom: 5px;"> Supplies <input type="checkbox"/> Tape <input type="checkbox"/> Packing materials <input type="checkbox"/> Baggies, Large garbage bags </div> <div style="text-align: center; border-bottom: 1px solid black; margin-bottom: 5px;">OTHER</div> <div style="margin-bottom: 5px;"> <input type="checkbox"/> Site POC name/phone # <input type="checkbox"/> Personnel information to POC <input type="checkbox"/> Mobilization schedule to POC <input type="checkbox"/> Site access authorizations <input type="checkbox"/> Field office / trailer arrangements made <input type="checkbox"/> Electric, phone hookups arranged <input type="checkbox"/> Steel-toed boots, safety glasses, & hard hat <input type="checkbox"/> First aid equipment <input type="checkbox"/> Insect repellent <input type="checkbox"/> _____ <input type="checkbox"/> _____ </div>

Note - not all items listed apply to every job, and some additional requirements may apply on a job-specific basis.



Project / Site:		Soil Boring ID No.: JAX	
Project No.: N4258		Sample Location: JAX	
<input checked="" type="checkbox"/> Temporary Monitoring Well		Sampler: _____	
<input checked="" type="checkbox"/> Soil Boring			
<input type="checkbox"/> Other: _____			

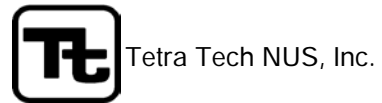
GROUNDWATER SAMPLING DATA								
Sample ID	Date	Time	Color	pH	S.C.	D.O.	Temp. (C)	Odor
JAX-								
Total Depth:		DTW:		Stickup:	NA	Screen Int:		

SOIL SAMPLE / DIRECT READ INSTRUMENT LOG DATA			
Soil Boring ID:	JAX-	Date:	
Location Desc:		Time Start:	
		Time End:	
		Time Sample:	
		Amount Grout:	
PID / FID READINGS			
Depth	Sample ID	Initial	Filtered

SAMPLE COLLECTION INFORMATION				
Analysis	Preservative	Container Requirements	Laboratory	Collected

OBSERVATIONS / NOTES		LAB INFO
PID CAL. _____ PPM Field Log Book No. _____		LAB: _____
Drilling Area Background (PPM): _____		COC #: _____

Check if Collected:		Signature(s):
<input type="checkbox"/> MS / MSD	<input type="checkbox"/> DUPLICATE / ID No.:	



EQUIPMENT CALIBRATION LOG

PROJECT NAME : _____

INSTRUMENT NAME/MODEL: _____

SITE NAME: _____

MANUFACTURER: _____

PROJECT No.: _____

SERIAL NUMBER: _____

[illegible]

Tetra Tech NUS, Inc.

PROJECT: _____

JOB & CTO #: _____ / _____

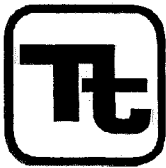
TOM: _____

LOCATION: _____

DEPART: _____

RETURN: _____

FIELD CHECKLIST		
TRAVEL	MISCELLANEOUS	
American Express <div> <div></div> <div>Airline reservations</div> </div> <div> <div></div> <div>Hotel reservations/BQOs</div> </div> <div> <div></div> <div>Car rental</div> </div> <div> <div></div> <div>Itinerary</div> </div>	<div> <div></div> <div>Site POC name/phone #</div> </div> <div> <div></div> <div>Schedule</div> <div>Plan field operations w/TOM</div> </div> <div> <div></div> <div>Documents</div> <div>Logbook(s)</div> <div>Work plan</div> <div>Field Sampling plan (1 per field tech.)</div> <div>Health & Safety plan</div> <div>Maps</div> </div> <div> <div></div> <div>Authorization</div> <div>Gov't rate letter</div> <div>H&S/OSHA 40-hour certficate</div> <div>8-Hour Refresher Training Certificate</div> <div>Medical Clearance Letter</div> <div>Supervisory Training Certificate</div> <div>Health & Safety Clearance Letter</div> <div>Full-size OSHA Poster</div> </div>	
DRILLING/DPT/SURVEY		
Subcontractor <div> <div></div> <div>POC phone #/address</div> </div> <div> <div></div> <div>Drill Specification RFP</div> </div> <div> <div></div> <div>Contact (time & place to meet)</div> </div> <div> <div></div> <div>Confirm Subcontract w/ S. Scaff</div> </div> <div> <div></div> <div>Health and Safety info. for all personnel on site</div> </div> <div> <div></div> <div>Copy of Drillers liscense</div> </div> <div> <div></div> <div></div> </div> <div> <div></div> <div>Utilities (2 weeks lead time?)</div> <div>Contact Site POC (Date:_____)</div> <div>Contact "Call Before You Dig"</div> <div>Utility Clearance Form</div> </div> <div> <div></div> <div>Forms</div> <div>Boring logs</div> <div>Well construction forms</div> <div>Daily activity forms</div> <div>IDW inventory/manifest</div> <div>IDW drum labels</div> <div>Chemical Inventory</div> <div>MSDS sheets</div> </div>	<th>HYDRO</th>	HYDRO
	<div> <div></div> <div>Forms</div> <div>Slug test/pumping test forms</div> <div>Groundwater elevation sheets</div> <div>Graph paper</div> <div>Hermit/slug/transducer/data cable</div> <div>Existing well const & water level data</div> </div>	
	<th>SHIPPING</th>	SHIPPING
	<div> <div></div> <div>Forms</div> <div>FedEx Airbills</div> <div>FedEx location</div> <div>FedEx Gov. Acct# (1771-8058-0)</div> <div>FedEx Package Windows</div> <div>Lab Shipping Labels</div> <div>Warehouse Shipping Labels</div> <div>Blank Labels</div> </div> <div> <div></div> <div>Supplies</div> <div>Tape</div> <div>Lg. garbage bags</div> </div>	
EQUIPMENT	OTHER	
<div> <div></div> <div>Fillout Equipment Requisition Form</div> </div> <div> <div></div> <div>Order equipment from TtNUS warehouse (Tom Patton)</div> </div> <div> <div></div> <div>Order rental/misc. equip</div> </div> <div> <div></div> <div>Equipment calibration forms</div> </div> <div> <div></div> <div>Span/cal. gas and regulator</div> </div>	<div> <div></div> <div>Personnell information to POC</div> </div> <div> <div></div> <div>Mobilization schedule to POC</div> </div> <div> <div></div> <div>Steel-toed boot & hard hat</div> </div> <div> <div></div> <div></div> </div> <div> <div></div> <div></div> </div> <div> <div></div> <div></div> </div> <div> <div></div> <div></div> </div> <div> <div></div> <div></div> </div> <div> <div></div> <div></div> </div> <div> <div></div> <div></div> </div>	
SAMPLING		
<div> <div></div> <div>Forms</div> <div>Sample log sheets</div> <div>COC records</div> <div>COC seals</div> <div>Sample labels (from Lee Leck)</div> </div> <div> <div></div> <div>Laboratory</div> <div>POC address/phone#</div> <div>Order bottles/hold times</div> <div>Shipping address</div> <div>Bottle & preservation requirements from lab</div> <div></div> </div>		



TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

Project/Installation Name _____

CTO & Project Number _____

Task Mod. Number _____

Modification To (e.g. Work Plan) _____

Site/Sample Location _____

Date _____

Activity Description: _____

Reason for Change: _____

Recommended Disposition: _____

Field Operations Leader (Signature) _____

Date _____

Approved Disposition: _____

Project/Task Order Manager (Signature) _____

Date _____

Distribution:

Program/Project File – _____

Project/Task Order Manager – _____

Field Operations Leader – _____

Other: _____

[illegible]

INCIDENT REPORT

Date of Report: _____

Site: _____

Site Location: _____

Report Prepared by: _____

Name (Printed)

Title

INCIDENT CATEGORY (check all that apply)

- | | | |
|--|---|--|
| <input type="checkbox"/> Injury | <input type="checkbox"/> Illness | <input type="checkbox"/> Property Damage |
| <input type="checkbox"/> Near-Miss | <input type="checkbox"/> Fire | <input type="checkbox"/> Chemical Exposure |
| <input type="checkbox"/> Motor Vehicle | <input type="checkbox"/> Onsite Equipment | <input type="checkbox"/> Electrical |
| <input type="checkbox"/> Mechanical | <input type="checkbox"/> Other | |

DATE AND TIME OF INCIDENT: _____

Narrative Report of Incident:

[illegible]

WITNESSES TO INCIDENT:

INCIDENT REPORT

Page 2

Site: _____

Date of Report: _____

1. Name _____ Company _____
Address _____
Telephone No. _____

2. Name _____ Company _____
Address _____
Telephone No. _____

INJURIES:**FIRST INJURED PERSON:**

Name and Address of Injured: _____

SSN: _____ Age: _____ Sex: _____

Years of Service: _____ Time on Present Job: _____

Title/Classification: _____

Severity of injury or illness: _____

_____ Disabling _____ Nondisabling

_____ Fatality _____ Medical Treatment

Estimated number of days away from job: _____

Nature of Injury or Illness: _____

Classification of Injury:

- ☐ Fractures
- ☐ Dislocations
- ☐ Sprains
- ☐ Abrasions
- ☐ Lacerations
- ☐ Punctures
- ☐ Faint/Dizziness
- ☐ Respiratory Allergy

- ☐ Heat Burns
- ☐ Chemical Burns
- ☐ Radiation Burns
- ☐ Bruises
- ☐ Blisters
- ☐ Toxic Respiratory
Exposure

- ☐ Cold Exposure
- ☐ Frostbite
- ☐ Heat Stroke
- ☐ Heat Exhaustion
- ☐ Concussion
- ☐ Bites
- ☐ Toxic Ingestion
- ☐ Dermal Allergy

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off site): _____

If Hospitalized:

Name, Address, and Telephone No. of Hospital: _____

Name, Address, and Telephone No. of Physician: _____

SECOND INJURED PERSON:

Name and Address of Injured: _____

INCIDENT REPORT

Page 3

Site: _____

Date of Report: _____

SSN: _____ Age: _____ Sex: _____

Years of Service: _____ Time on Present Job: _____

Title/Classification: _____

Severity of injury or illness: _____

_____ Disabling _____ Nondisabling

_____ Fatality _____ Medical Treatment

Estimated number of days away from job: _____

Nature of Injury or Illness: _____

Classification of Injury:

- ☐ Fractures
- ☐ Dislocations
- ☐ Sprains
- ☐ Abrasions
- ☐ Lacerations
- ☐ Punctures
- ☐ Faint/Dizziness
- ☐ Respiratory Allergy

- ☐ Heat Burns
- ☐ Chemical Burns
- ☐ Radiation Burns
- ☐ Bruises
- ☐ Blisters
- ☐ Toxic Respiratory Exposure

- ☐ Cold Exposure
- ☐ Frostbite
- ☐ Heat Stroke
- ☐ Heat Exhaustion
- ☐ Concussion
- ☐ Bites
- ☐ Toxic Ingestion
- ☐ Dermal Allergy

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off site): _____

If Hospitalized:

Name, Address, and Telephone No. of Hospital: _____

Name, Address, and Telephone No. of Physician: _____

PROPERTY DAMAGE:

Brief Description of Property Damaged

Estimate of Damage: \$ _____

INCIDENT LOCATION:_____

_____**INCIDENT ANALYSIS:**

INCIDENT REPORT**Page 4****Site:** _____**Date of Report:** _____

Causative agent most directly related to accident (object, substance, material, machinery, equipment, conditions):

Was weather a factor? _____

Unsafe mechanical/physical/environmental condition at time of incident (be specific):

Unsafe act by injured and/or others contributing to the Incident (be specific, must be answered):

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue):

Onsite Incidents:

Level of personal protection equipment required in Site Safety Plan:

Modifications:

Was injured using required equipment?

If not, how did actual equipment use differ from plan?

INCIDENT REPORT

Page 5

Site: _____

Date of Report: _____

ACTION TAKEN TO PREVENT RECURRENCE:

INCIDENT REPORT COMPLETED BY:

_____ Site Safety Officer	_____ SSO Signature
------------------------------	------------------------

OTHERS PARTICIPATING IN INVESTIGATION:

_____ Name (Printed)	_____ Signature	_____ Title
_____ Name (Printed)	_____ Signature	_____ Title
_____ Name (Printed)	_____ Signature	_____ Title

INCIDENT REPORT REVIEWED BY:

_____ Matthew M. Soltis, CIH, CSP	CLEAN, Health and Safety Manager
--------------------------------------	----------------------------------

Tetra Tech NUS, Inc.

PROJECT: _____ LOCATION: _____
 JOB & CTO #: _____ MOBILIZATION DATE: _____
 PROJECT MANAGER: _____ RETURN DATE: _____

FIELD PROJECT PRE-MOBILIZATION CHECKLIST	
<p style="text-align: center; margin: 0;">TRAVEL</p> <p>___ Airline reservations</p> <p>___ Hotel reservations/BOQs</p> <p>___ Vehicle rental</p> <p>___ Itinerary</p> <p>___ Phone/pager number</p> <p style="text-align: center; margin: 0;">DRILLING/DPT/SURVEY</p> <p>Subcontractor</p> <p>___ POC phone #/address</p> <p>___ Drill Specification RFP</p> <p>___ Contact (time & place to meet)</p> <p>___ Confirm subcontract w/ TtNUS Procurement</p> <p>___ Health and Safety documentation for all personnel on site</p> <p>___ Copy of Drillers license</p> <p>___ Well / boring permits</p> <p>Utilities (2 weeks lead time)</p> <p>___ Contact Site POC (Date: _____)</p> <p>___ Contact Local "Call Before You Dig"</p> <p>___ Utility Clearance Form</p> <p>Forms</p> <p>___ Boring logs / Test Pit logs</p> <p>___ Well construction / development forms</p> <p>___ Daily activity forms</p> <p>___ IDW inventory</p> <p>___ IDW drum labels</p> <p>___ Chemical Inventory</p> <p>___ MSDS's</p> <p style="text-align: center; margin: 0;">EQUIPMENT MOBILIZATION</p> <p>___ Equipment Requisition form completed / equipment ordered</p> <p>___ 3rd Party rental / misc. equipment ordered</p> <p>___ Equipment calibration forms</p> <p>___ Span / calibration gas and regulator</p> <p style="text-align: center; margin: 0;">SAMPLING</p> <p>Forms</p> <p>___ Sample log sheets</p> <p>___ Low-flow purge data sheets</p> <p>___ COC records</p> <p>___ COC seals</p> <p>___ Sample labels (from database group)</p> <p>Laboratory</p> <p>___ POC address/phone#</p> <p>___ Order bottles / preservatives</p> <p>___ Shipping address, also check Sat. address</p> <p>___ Bottle & preservation req'ts from lab</p> <p>___ _____</p>	<p style="text-align: center; margin: 0;">MISCELLANEOUS</p> <p>Schedule</p> <p>___ Plan field operations w/ Project manager</p> <p>Documents for Field Program</p> <p>___ Logbook(s)</p> <p>___ Field Sampling plan</p> <p>___ Health & Safety plan</p> <p>___ Maps</p> <p>___ H & S Guidance Manual</p> <p>Authorization</p> <p>___ Kick-off meeting held</p> <p>___ Gov't rate letter</p> <p>___ H&S/OSHA 40-hour certificate</p> <p>___ 8-Hour Refresher Training Certificate</p> <p>___ Medical Clearance Letter</p> <p>___ Supervisory Training Certificate</p> <p>___ Health & Safety Clearance Letter</p> <p>___ Full-size OSHA Poster</p> <p style="text-align: center; margin: 0;">HYDROGEOLOGY EQUIPMENT</p> <p>___ Slug test/pumping test forms</p> <p>___ Groundwater elevation data sheets</p> <p>___ Graph paper</p> <p>___ Data Logger/transducer/data cable</p> <p>___ Existing well construction & water level data</p> <p>___ M-Scope, slug</p> <p style="text-align: center; margin: 0;">SHIPPING</p> <p>Forms</p> <p>___ FedEx Airbills, local dropoff location & hours</p> <p>___ FedEx Gov. Acct# (1771-8058-0)</p> <p>___ Lab Shipping Labels</p> <p>___ Warehouse Shipping Labels</p> <p>___ Blank Labels</p> <p>Supplies</p> <p>___ Tape</p> <p>___ Packing materials</p> <p>___ Baggies, Large garbage bags</p> <p style="text-align: center; margin: 0;">OTHER</p> <p>___ Site POC name/phone #</p> <p>___ Personnel information to POC</p> <p>___ Mobilization schedule to POC</p> <p>___ Site access authorizations</p> <p>___ Field office / trailer arrangements made</p> <p>___ Electric, phone hookups arranged</p> <p>___ Steel-toed boots, safety glasses, & hard hat</p> <p>___ First aid equipment</p> <p>___ Insect repellent</p> <p>___ _____</p> <p>___ _____</p>

Note - not all items listed apply to every job, and some additional requirements may apply on a job-specific basis.

Project Change Form

Fully executed Change Order documentation is required and must be attached.

Project Number:	PM:
------------------------	------------

Client:	Customer Order #:
----------------	--------------------------

Site:

Original TPV:	
Change order:	
New TPV:	

Change Type:

	Budgetary Increase
	Budgetary Decrease

	Rate Change

Description of Change: (Briefly describe scope changes or detail any fixed hourly rate changes)

Add Chargeable Departments:

	Florida (FLOR)
	Pittsburgh (PITT)
	Gaithersburg (GBRG)
	Procurement (PROC)

	Oakridge (OAKR)
	Atlanta (ATLT)
	Aiken (AIKN)
	Philadelphia (PHIL)
	Boston (BOST)

Change Rates to:

	OH	G&A	Fee	Effective Date
Labor				
ODC's				
Subs				
All				

Add Project Team Members: (To be added to ETS)

Technical Staff

Admin

Contracts
Procurement

PM Approval:

OM Approval:

Date Submitted:

Date:



QA SAMPLE LOG SHEET

Page ____ of ____

Project Site Name:	_____	Sample ID Number:	_____
Project Number:	_____	Sampled By:	_____
Sample Location:	_____	C.O.C. Number:	_____
QA Sample Type:			
	<input type="checkbox"/> Trip Blank	<input type="checkbox"/> Rinsate Blank	
	<input type="checkbox"/> Source Water Blank	<input type="checkbox"/> Other Blank	_____

SAMPLING DATA:	WATER SOURCE:	
Date: _____	<input type="checkbox"/> Laboratory Prepared	<input type="checkbox"/> Tap
Time: _____	<input type="checkbox"/> Purchased	<input type="checkbox"/> Fire Hydrant
Method: _____	<input type="checkbox"/> Other _____	

PURCHASED WATER INFORMATION (If Applicable as Source or Rinsate Water):	RINSATE INFORMATION (If Applicable):
Product Name: _____	Media Type: _____
Supplier: _____	Equipment Used: _____
Manufacturer: _____	Equipment Type: _____
Order Number: _____	<input type="checkbox"/> Dedicated
Lot Number: _____	<input type="checkbox"/> Reusable
Expiration Date: _____	

SAMPLE COLLECTION INFORMATION:			
Analysis	Preservative	Container Requirements	Collected
Volatiles	Cool 4°C & HCl		YES / NO
Semivolatiles	Cool 4°C		YES / NO
Pesticide / PCB	Cool 4°C		YES / NO
Metals	Cool 4°C & HNO ₃		YES / NO
Cyanide	Cool 4°C & NaOH		YES / NO

OBSERVATIONS / NOTES:
<div></div> <div>Signature(s):</div>



SOIL & SEDIMENT SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: _____
Project No.: _____

- ☐ Surface Soil
☐ Subsurface Soil
☐ Sediment
☐ Other: _____
☐ QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
☐ Low Concentration
☐ High Concentration

GRAB SAMPLE DATA:

Date:	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:**MAP:**

--	--

Circle if Applicable:

Signature(s):

MS/MSD

Duplicate ID No.:

Project/Installation Name _____ To _____	Project Number _____ Site/Sample Location _____	Task Mod. Number _____ Date _____
Description: _____ _____ _____ _____ _____		
Reason for Change: _____ _____ _____ _____ _____		
Recommended Disposition: _____ _____ _____ _____ _____		
Field Operations Leader (Signature) _____	Date _____	
Disposition: _____ _____ _____ _____ _____		
Task Order Manager (Signature) _____	Date _____	
Distribution: Program Coordinator- _____ Quality Assurance Officer - _____ Task Order Manager - _____ Field Operations Leader - _____		
Others: _____ _____ _____ _____		

APPENDIX D

LABORATORY DoD ELAP ACCREDITATION / FDOH CERTIFICATION



**LABORATORY
ACCREDITATION
BUREAU**

Certificate of Accreditation

ISO/IEC 17025:2005

Certificate Number L2226

Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).*

The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation Granted through: November 30, 2012

**R. Douglas Leonard, Jr., Managing Director
Laboratory Accreditation Bureau
Presented the 30th of November 2009**

*See the laboratory's Scope of Accreditation for details of the DoD ELAP requirements

Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

Scope of Accreditation For Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228
Marcia K. McGinnity
1-877-345-1113

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Empirical Laboratories, LLC to perform the following tests:

Accreditation granted through: **November 30, 2012**

Testing - Environmental

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	EPA 8260B	1,1,2-Trichloroethane
GC/MS	EPA 8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	EPA 8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	EPA 8260B	1,1-Dichloropropene
GC/MS	EPA 8260B	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B	1,2,3-Trichloropropane
GC/MS	EPA 8260B	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260B	1,2-Dichlorobenzene
GC/MS	EPA 8260B	1,2-Dichloroethane (EDC)
GC/MS	EPA 8260B	1,2-Dichloropropane
GC/MS	EPA 8260B	1,3,5-Trimethylbenzene

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,3-Dichlorobenzene
GC/MS	EPA 8260B	1,3-Dichloropropane
GC/MS	EPA 8260B	1,4-Dichlorobenzene
GC/MS	EPA 8260B	1-Chlorohexane
GC/MS	EPA 8260B	2,2-Dichloropropane
GC/MS	EPA 8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	EPA 8260B	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B	2-Chlorotoluene
GC/MS	EPA 8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	EPA 8260B	4-Chlorotoluene
GC/MS	EPA 8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	EPA 8260B	Acetone
GC/MS	EPA 8260B	Acrolein
GC/MS	EPA 8260B	Acrylonitrile
GC/MS	EPA 8260B	Benzene
GC/MS	EPA 8260B	Bromobenzene
GC/MS	EPA 8260B	Bromochloromethane
GC/MS	EPA 8260B	Bromodichloromethane
GC/MS	EPA 8260B	Bromoform
GC/MS	EPA 8260B	Bromomethane
GC/MS	EPA 8260B	Carbon Disulfide
GC/MS	EPA 8260B	Carbon Tetrachloride
GC/MS	EPA 8260B	Chlorobenzene
GC/MS	EPA 8260B	Chloroethane
GC/MS	EPA 8260B	Chloroform
GC/MS	EPA 8260B	Chloromethane
GC/MS	EPA 8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	EPA 8260B	cis-1,3-Dichloropropene
GC/MS	EPA 8260B	Cyclohexane
GC/MS	EPA 8260B	Dibromochloromethane
GC/MS	EPA 8260B	Dibromomethane
GC/MS	EPA 8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	EPA 8260B	Di-isopropyl ether

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	ETBE
GC/MS	EPA 8260B	Ethyl methacrylate
GC/MS	EPA 8260B	Ethylbenzene
GC/MS	EPA 8260B	Hexachlorobutadiene
GC/MS	EPA 8260B	Iodomethane
GC/MS	EPA 8260B	Isopropylbenzene (Cumene)
GC/MS	EPA 8260B	Methyl Acetate
GC/MS	EPA 8260B	Methyl methacrylate
GC/MS	EPA 8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	EPA 8260B	Methylcyclohexane
GC/MS	EPA 8260B	Methylene Chloride, or Dichloromethane
GC/MS	EPA 8260B	Naphthalene
GC/MS	EPA 8260B	n-Butylbenzene
GC/MS	EPA 8260B	n-Propylbenzene
GC/MS	EPA 8260B	p-Isopropyltoluene
GC/MS	EPA 8260B	sec-Butylbenzene
GC/MS	EPA 8260B	Styrene
GC/MS	EPA 8260B	t-Butyl alcohol
GC/MS	EPA 8260B	tert-Amyl methyl ether
GC/MS	EPA 8260B	tert-Butylbenzene
GC/MS	EPA 8260B	Tetrachloroethene (PCE; PERC)
GC/MS	EPA 8260B	Tetrahydrofuran
GC/MS	EPA 8260B	Toluene
GC/MS	EPA 8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	EPA 8260B	trans-1,3-Dichloropropene
GC/MS	EPA 8260B	Trichloroethene (TCE)
GC/MS	EPA 8260B	Trichlorofluoromethane (CFC-11)
GC/MS	EPA 8260B	Vinyl acetate
GC/MS	EPA 8260B	Vinyl Chloride (VC)
GC/MS	EPA 8260B	Xylenes (Total)
GC/MS	EPA 8270C/D	1,1'-Biphenyl
GC/MS	EPA 8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/D	1,2,4-Trichlorobenzene

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/D	1,2-Diphenylhydrazine
GC/MS	EPA 8270C/D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dioxane
GC/MS	EPA 8270C/D	1-Methylnaphthalene
GC/MS	EPA 8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	EPA 8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	EPA 8270C/D	2,4-Dimethylphenol
GC/MS	EPA 8270C/D	2,4-Dinitrophenol
GC/MS	EPA 8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	EPA 8270C/D	2,6-Dichlorophenol
GC/MS	EPA 8270C/D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/D	2-Chloronaphthalene
GC/MS	EPA 8270C/D	2-Chlorophenol
GC/MS	EPA 8270C/D	2-Methylnaphthalene
GC/MS	EPA 8270C/D	2-Methylphenol (o-Cresol)
GC/MS	EPA 8270C/D	2-Nitroaniline
GC/MS	EPA 8270C/D	2-Nitrophenol (ONP)
GC/MS	EPA 8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	EPA 8270C/D	3-Methylphenol
GC/MS	EPA 8270C/D	3-Nitroaniline
GC/MS	EPA 8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	EPA 8270C/D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/D	4-Chloroaniline
GC/MS	EPA 8270C/D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Methylphenol (p-Cresol)
GC/MS	EPA 8270C/D	4-Nitroaniline (PNA)
GC/MS	EPA 8270C/D	4-Nitrophenol (PNP)
GC/MS	EPA 8270C/D	7,12-Dimethylbenz(a)anthracene

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Acenaphthene
GC/MS	EPA 8270C/D	Acenaphthylene
GC/MS	EPA 8270C/D	Acetaphenone
GC/MS	EPA 8270C/D	Aniline
GC/MS	EPA 8270C/D	Anthracene
GC/MS	EPA 8270C/D	Atrazine
GC/MS	EPA 8270C/D	Benzaldehyde
GC/MS	EPA 8270C/D	Benzidine
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)pyrene
GC/MS	EPA 8270C/D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D	Benzoic Acid
GC/MS	EPA 8270C/D	Benzyl alcohol
GC/MS	EPA 8270C/D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	EPA 8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	EPA 8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	EPA 8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	EPA 8270C/D	Caprolactam
GC/MS	EPA 8270C/D	Carbazole
GC/MS	EPA 8270C/D	Chrysene
GC/MS	EPA 8270C/D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/D	Dibenzofuran (DBF)
GC/MS	EPA 8270C/D	Diethyl phthalate (DEP)
GC/MS	EPA 8270C/D	Dimethyl phthalate (DMP)
GC/MS	EPA 8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	EPA 8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	EPA 8270C/D	Fluoranthene
GC/MS	EPA 8270C/D	Fluorene
GC/MS	EPA 8270C/D	Hexachlorobenzene (HCB)

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	EPA 8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	EPA 8270C/D	Hexachloroethane (HCE)
GC/MS	EPA 8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/D	Isophorone
GC/MS	EPA 8270C/D	Naphthalene
GC/MS	EPA 8270C/D	Nitrobenzene
GC/MS	EPA 8270C/D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	EPA 8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	EPA 8270C/D	Pentachlorophenol
GC/MS	EPA 8270C/D	Phenanthrene
GC/MS	EPA 8270C/D	Phenol
GC/MS	EPA 8270C/D	Pyrene
GC/MS	EPA 8270C/D	Pyridine
GC/ECD	EPA 8081A/B	4,4'-DDD
GC/ECD	EPA 8081A/B	4,4'-DDE
GC/ECD	EPA 8081A/B	4,4'-DDT
GC/ECD	EPA 8081A/B	Aldrin
GC/ECD	EPA 8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	EPA 8081A/B	alpha-Chlordane
GC/ECD	EPA 8081A/B	beta-BHC (beta-HCH)
GC/ECD	EPA 8081A/B	delta-BHC (delta-HCH)
GC/ECD	EPA 8081A/B	Dieldrin
GC/ECD	EPA 8081A/B	Endosulfan I
GC/ECD	EPA 8081A/B	Endosulfan II
GC/ECD	EPA 8081A/B	Endosulfan sulfate
GC/ECD	EPA 8081A/B	Endrin
GC/ECD	EPA 8081A/B	Endrin aldehyde
GC/ECD	EPA 8081A/B	Endrin ketone
GC/ECD	EPA 8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	EPA 8081A/B	gamma-Chlordane
GC/ECD	EPA 8081A/B	Heptachlor

Non-Potable Water		
Technology	Method	Analyte
GC/ECD	EPA 8081A/B	Heptachlor epoxide
GC/ECD	EPA 8081A/B	Methoxychlor
GC/ECD	EPA 8081A/B	Chlordane
GC/ECD	EPA 8081A/B	Toxaphene
GC/ECD	EPA 8082 /A	Aroclor-1016
GC/ECD	EPA 8082 /A	Aroclor-1221
GC/ECD	EPA 8082 /A	Aroclor-1232
GC/ECD	EPA 8082 /A	Aroclor-1242
GC/ECD	EPA 8082 /A	Aroclor-1248
GC/ECD	EPA 8082 /A	Aroclor-1254
GC/ECD	EPA 8082 /A	Aroclor-1260
GC/ECD	EPA 8082 /A	Aroclor-1262
GC/ECD	EPA 8082 /A	Aroclor-1268
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4,5-TP (Silvex)
GC/ECD	EPA 8151A	2,4-D
GC/ECD	EPA 8151A	2,4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichlorprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP (Mecoprop)
HPLC/UV	EPA 8330A/B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A/B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A/B	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330A/B	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330A/B	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330A/B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A/B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A/B	2-Nitrotoluene (ONT)
HPLC/UV	EPA 8330A/B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/B	3-Nitrotoluene

Non-Potable Water		
Technology	Method	Analyte
HPLC/UV	EPA 8330A/B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A/B	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330A/B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330A/B	Nitrobenzene
HPLC/UV	EPA 8330A/B	Nitroglycerin
HPLC/UV	EPA 8330A/B	Nitroguanidine
HPLC/UV	EPA 8330A/B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330A/B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/B	PETN
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	EPA 8015B	TPH DRO
GC/FID	EPA 8015B	TPH GRO
GC/FID	RSK-175	Methane
GC/FID	RSK-175	Ethane
GC/FID	RSK-175	Ethene
GC/ECD	EPA 8011	1,2-Dibromoethane (EDB)
GC/ECD	EPA 8011	1,2-Dibromo-3-chloropropane (DBCP)
HPLC/MS	EPA 6850	Perchlorate
ICP	EPA 6010B/C	Aluminum
ICP	EPA 6010B/C	Antimony
ICP	EPA 6010B/C	Arsenic
ICP	EPA 6010B/C	Barium
ICP	EPA 6010B/C	Beryllium
ICP	EPA 6010B/C	Boron
ICP	EPA 6010B/C	Cadmium
ICP	EPA 6010B/C	Calcium
ICP	EPA 6010B/C	Chromium, total
ICP	EPA 6010B/C	Cobalt
ICP	EPA 6010B/C	Copper
ICP	EPA 6010B/C	Iron
ICP	EPA 6010B/C	Lead
ICP	EPA 6010B/C	Magnesium
ICP	EPA 6010B/C	Manganese

Non-Potable Water		
Technology	Method	Analyte
CVAA	EPA 6010B/C	Mercury
ICP	EPA 6010B/C	Molybdenum
ICP	EPA 6010B/C	Nickel
ICP	EPA 6010B/C	Potassium
ICP	EPA 6010B/C	Selenium
ICP	EPA 6010B/C	Silver
ICP	EPA 6010B/C	Sodium
ICP	EPA 6010B/C	Strontium
ICP	EPA 6010B/C	Thallium
ICP	EPA 6010B/C	Tin
ICP	EPA 6010B/C	Titanium
ICP	EPA 6010B/C	Vanadium
ICP	EPA 6010B/C	Zinc
IC	EPA 300.0	Chloride
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Nitrite
IC	EPA 300.0	Sulfate
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate
IC	EPA 9056A	Nitrite
IC	EPA 9056A	Sulfate
Titration	SM 2320B 20 th /21 st edition	Alkalinity
Colorimetric	SM 4500 B, G, 20 th /21 st edition	Ammonia
UV/Vis	EPA 7196A	Hexavalent Chromium
Colorimetric	EPA 353.2	Nitrocellulose
Colorimetric	EPA 353.2	Nitrate/Nitrite
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	SM 4500 S-2CF, 20 th /21 st edition	Sulfide
UV/Vis	SM 4500 P B5, E, 20 th /21 st edition	Total Phosphorus (as P)

Non-Potable Water		
Technology	Method	Analyte
UV/Vis	SM 4500 PE, 20 th /21 st edition	Ortho-Phosphate (as P)
TOC	9060A/SM5310C, 20 th /21 st edition	Total Organic Carbon
Gravimetric	SM 2540C, 20 th /21 st edition	TDS
Colorimetric	EPA 9012A/B	Cyanide
Physical	EPA 1010A	Ignitability
Physical	EPA 9095B	Paint Filter
Probe	EPA 9040B/C	pH
Preparation	Method	Type
Preparation	EPA 1311	TCLP
Preparation	EPA 3005A	Metals digestion
Preparation	EPA 3010A	Metals digestion
Preparation	EPA 3510C	Organics Liquid Extraction
Preparation	EPA 5030A/B	Purge and Trap Water

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	EPA 8260B	1,1,2-Trichloroethane
GC/MS	EPA 8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	EPA 8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	EPA 8260B	1,1-Dichloropropene
GC/MS	EPA 8260B	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B	1,2,3-Trichloropropane
GC/MS	EPA 8260B	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B	1,2-Dibromoethane (EDB)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,2-Dichlorobenzene
GC/MS	EPA 8260B	1,2-Dichloroethane (EDC)
GC/MS	EPA 8260B	1,2-Dichloropropane
GC/MS	EPA 8260B	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B	1,3-Dichlorobenzene
GC/MS	EPA 8260B	1,3-Dichloropropane
GC/MS	EPA 8260B	1,4-Dichlorobenzene
GC/MS	EPA 8260B	2,2-Dichloropropane
GC/MS	EPA 8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	EPA 8260B	2-Chlorotoluene
GC/MS	EPA 8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	EPA 8260B	4-Chlorotoluene
GC/MS	EPA 8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	EPA 8260B	Acetone
GC/MS	EPA 8260B	Acrolein
GC/MS	EPA 8260B	Acrylonitrile
GC/MS	EPA 8260B	Benzene
GC/MS	EPA 8260B	Bromobenzene
GC/MS	EPA 8260B	Bromochloromethane
GC/MS	EPA 8260B	Bromodichloromethane
GC/MS	EPA 8260B	Bromoform
GC/MS	EPA 8260B	Bromomethane
GC/MS	EPA 8260B	Carbon Disulfide
GC/MS	EPA 8260B	Carbon Tetrachloride
GC/MS	EPA 8260B	Chlorobenzene
GC/MS	EPA 8260B	Chloroethane
GC/MS	EPA 8260B	Chloroform
GC/MS	EPA 8260B	Chloromethane
GC/MS	EPA 8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	EPA 8260B	cis-1,3-Dichloropropene
GC/MS	EPA 8260B	Cyclohexane
GC/MS	EPA 8260B	Dibromochloromethane

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	Dibromomethane
GC/MS	EPA 8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	EPA 8260B	Ethyl methacrylate
GC/MS	EPA 8260B	Ethylbenzene
GC/MS	EPA 8260B	Hexachlorobutadiene
GC/MS	EPA 8260B	Iodomethane
GC/MS	EPA 8260B	Isopropylbenzene (Cumene)
GC/MS	EPA 8260B	Methyl Acetate
GC/MS	EPA 8260B	Methyl methacrylate
GC/MS	EPA 8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	EPA 8260B	Methylcyclohexane
GC/MS	EPA 8260B	Methylene Chloride, or Dichloromethane
GC/MS	EPA 8260B	Naphthalene
GC/MS	EPA 8260B	n-Butylbenzene
GC/MS	EPA 8260B	n-Propylbenzene
GC/MS	EPA 8260B	p-Isopropyltoluene
GC/MS	EPA 8260B	sec-Butylbenzene
GC/MS	EPA 8260B	Styrene
GC/MS	EPA 8260B	tert-Butylbenzene
GC/MS	EPA 8260B	Tetrachloroethene (PCE; PERC)
GC/MS	EPA 8260B	Toluene
GC/MS	EPA 8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	EPA 8260B	trans-1,3-Dichloropropene
GC/MS	EPA 8260B	Trichloroethene (TCE)
GC/MS	EPA 8260B	Trichlorofluoromethane (CFC-11)
GC/MS	EPA 8260B	Vinyl acetate
GC/MS	EPA 8260B	Vinyl Chloride (VC)
GC/MS	EPA 8260B	Xylenes (Total)
GC/MS	EPA 8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	EPA 8270C/D	1,1'-Biphenyl
GC/MS	EPA 8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/D	1,2,4-Trichlorobenzene

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/D	1,2-Diphenylhydrazine
GC/MS	EPA 8270C/D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dioxane
GC/MS	EPA 8270C/D	1-Methylnaphthalene
GC/MS	EPA 8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	EPA 8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	EPA 8270C/D	2,4-Dimethylphenol
GC/MS	EPA 8270C/D	2,4-Dinitrophenol
GC/MS	EPA 8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	EPA 8270C/D	2,6-Dichlorophenol
GC/MS	EPA 8270C/D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/D	2-Chloronaphthalene
GC/MS	EPA 8270C/D	2-Chlorophenol
GC/MS	EPA 8270C/D	2-Methylnaphthalene
GC/MS	EPA 8270C/D	2-Methylphenol (o-Cresol)
GC/MS	EPA 8270C/D	2-Nitroaniline
GC/MS	EPA 8270C/D	2-Nitrophenol (ONP)
GC/MS	EPA 8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	EPA 8270C/D	3-Methylphenol
GC/MS	EPA 8270C/D	3-Nitroaniline
GC/MS	EPA 8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	EPA 8270C/D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/D	4-Chloroaniline
GC/MS	EPA 8270C/D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Methylphenol (p-Cresol)
GC/MS	EPA 8270C/D	4-Nitroaniline (PNA)
GC/MS	EPA 8270C/D	4-Nitrophenol (PNP)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Acenaphthene
GC/MS	EPA 8270C/D	Acenaphthylene
GC/MS	EPA 8270C/D	Acetaphenone
GC/MS	EPA 8270C/D	Aniline
GC/MS	EPA 8270C/D	Anthracene
GC/MS	EPA 8270C/D	Atrazine
GC/MS	EPA 8270C/D	Benzaldehyde
GC/MS	EPA 8270C/D	Benzidine
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)pyrene
GC/MS	EPA 8270C/D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D	Benzoic Acid
GC/MS	EPA 8270C/D	Benzyl alcohol
GC/MS	EPA 8270C/D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	EPA 8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	EPA 8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	EPA 8270C/D	Caprolactam
GC/MS	EPA 8270C/D	Carbazole
GC/MS	EPA 8270C/D	Chrysene
GC/MS	EPA 8270C/D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/D	Dibenzofuran (DBF)
GC/MS	EPA 8270C/D	Diethyl phthalate (DEP)
GC/MS	EPA 8270C/D	Dimethyl phthalate (DMP)
GC/MS	EPA 8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	EPA 8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	EPA 8270C/D	Fluoranthene
GC/MS	EPA 8270C/D	Fluorene
GC/MS	EPA 8270C/D	Hexachlorobenzene (HCB)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Hexachlorobutadiene (HCBd)
GC/MS	EPA 8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	EPA 8270C/D	Hexachloroethane (HCE)
GC/MS	EPA 8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/D	Isophorone
GC/MS	EPA 8270C/D	Naphthalene
GC/MS	EPA 8270C/D	Nitrobenzene
GC/MS	EPA 8270C/D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	EPA 8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	EPA 8270C/D	Pentachlorophenol
GC/MS	EPA 8270C/D	Phenanthrene
GC/MS	EPA 8270C/D	Phenol
GC/MS	EPA 8270C/D	Pyrene
GC/MS	EPA 8270C/D	Pyridine
GC/ECD	EPA 8081A/B	4,4'-DDD
GC/ECD	EPA 8081A/B	4,4'-DDE
GC/ECD	EPA 8081A/B	4,4'-DDT
GC/ECD	EPA 8081A/B	Aldrin
GC/ECD	EPA 8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	EPA 8081A/B	alpha-Chlordane
GC/ECD	EPA 8081A/B	beta-BHC (beta-HCH)
GC/ECD	EPA 8081A/B	delta-BHC (delta-HCH)
GC/ECD	EPA 8081A/B	Chlordane
GC/ECD	EPA 8081A/B	Dieldrin
GC/ECD	EPA 8081A/B	Endosulfan I
GC/ECD	EPA 8081A/B	Endosulfan II
GC/ECD	EPA 8081A/B	Endosulfan sulfate
GC/ECD	EPA 8081A/B	Endrin
GC/ECD	EPA 8081A/B	Endrin aldehyde
GC/ECD	EPA 8081A/B	Endrin ketone
GC/ECD	EPA 8081A/B	gamma-BHC (Lindane; gamma-HCH)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/ECD	EPA 8081A/B	gamma-Chlordane
GC/ECD	EPA 8081A/B	Heptachlor
GC/ECD	EPA 8081A/B	Heptachlor epoxide
GC/ECD	EPA 8081A/B	Methoxychlor
GC/ECD	EPA 8081A/B	Toxaphene
GC/ECD	EPA 8082 /A	Aroclor-1016
GC/ECD	EPA 8082 /A	Aroclor-1221
GC/ECD	EPA 8082 /A	Aroclor-1232
GC/ECD	EPA 8082 /A	Aroclor-1242
GC/ECD	EPA 8082 /A	Aroclor-1248
GC/ECD	EPA 8082 /A	Aroclor-1254
GC/ECD	EPA 8082 /A	Aroclor-1260
GC/ECD	EPA 8082 /A	Aroclor-1262
GC/ECD	EPA 8082 /A	Aroclor-1268
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4,5-TP (Silvex)
GC/ECD	EPA 8151A	2,4-D
GC/ECD	EPA 8151A	2,4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichlorprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP (Mecoprop)
HPLC/UV	EPA 8330A	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330A	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A	2-Nitrotoluene (ONT)

Solid and Chemical Materials		
Technology	Method	Analyte
HPLC/UV	EPA 8330A	3-Nitrotoluene
HPLC/UV	EPA 8330A	3,5-Dinitroaniline
HPLC/UV	EPA 8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330A	Nitroglycerin
HPLC/UV	EPA 8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330A	Nitrobenzene
HPLC/UV	EPA 8330A	Nitroguanidine
HPLC/UV	EPA 8330A	PETN
HPLC/UV	EPA 8330B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330B	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330B	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330B	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330B	2-Nitrotoluene (ONT)
HPLC/UV	EPA 8330B	3-Nitrotoluene
HPLC/UV	EPA 8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330B	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330B	Nitroglycerin
HPLC/UV	EPA 8330B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330B	Nitrobenzene
HPLC/UV	EPA 8330B	Nitroguanidine
HPLC/UV	EPA 8330B	PETN
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	EPA 8015B	TPH DRO
GC/FID	EPA 8015B	TPH GRO
HPLC/MS	EPA 6850	Perchlorate

Solid and Chemical Materials		
Technology	Method	Analyte
ICP	EPA 6010B/C	Aluminum
ICP	EPA 6010B/C	Antimony
ICP	EPA 6010B/C	Arsenic
ICP	EPA 6010B/C	Barium
ICP	EPA 6010B/C	Beryllium
ICP	EPA 6010B/C	Boron
ICP	EPA 6010B/C	Cadmium
ICP	EPA 6010B/C	Calcium
ICP	EPA 6010B/C	Chromium, total
ICP	EPA 6010B/C	Cobalt
ICP	EPA 6010B/C	Copper
ICP	EPA 6010B/C	Iron
ICP	EPA 6010B/C	Lead
ICP	EPA 6010B/C	Magnesium
ICP	EPA 6010B/C	Manganese
CVAA	EPA 7471A/B	Mercury
ICP	EPA 6010B/C	Molybdenum
ICP	EPA 6010B/C	Nickel
ICP	EPA 6010B/C	Potassium
ICP	EPA 6010B/C	Selenium
ICP	EPA 6010B/C	Silver
ICP	EPA 6010B/C	Sodium
ICP	EPA 6010B/C	Strontium
ICP	EPA 6010B/C	Tin
ICP	EPA 6010B/C	Titanium
ICP	EPA 6010B/C	Thallium
ICP	EPA 6010B/C	Vanadium
ICP	EPA 6010B/C	Zinc
UV/Vis	EPA 7196A	Hexavalent Chromium
TOC	Lloyd Kahn	Total Organic Carbon
Colorimetric	EPA 353.2	Nitrocellulose
Colorimetric	EPA 9012A/B	Cyanide

Solid and Chemical Materials		
Technology	Method	Analyte
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	EPA 9034	Sulfide
Probe	EPA 9045C/D	pH
Preparation	Method	Type
Preparation	EPA 1311	TCLP
Preparation	EPA 1312	SPLP
Preparation	NJ Modified 3060A	Hexavalent Chromium
Preparation	EPA 3050B	Metals Digestion
Preparation	EPA 3546	Organics Microwave Extraction
Preparation	EPA 3550B/C	Organics Sonication
Preparation	SM 2540B 20 th /21 st edition	Percent Solids (Percent Moisture)
Preparation	EPA 5035 /A	Purge and Trap Solid

Notes:

- 1) This laboratory offers commercial testing service.

Approved By:



 R. Douglas Leonard
Chief Technical Officer

 Date: January 25, 2011

Scope of Accreditation For Empirical Laboratories, LLC

621 Mainstream Drive, Suite 270
Nashville, TN 37228
Marcia K. McGinnity
1-877-345-1113

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Empirical Laboratories, LLC to perform the following tests:

Accreditation granted through: **November 30, 2012**

Testing - Environmental

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	EPA 8260B	1,1,2-Trichloroethane
GC/MS	EPA 8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	EPA 8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	EPA 8260B	1,1-Dichloropropene
GC/MS	EPA 8260B	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B	1,2,3-Trichloropropane
GC/MS	EPA 8260B	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260B	1,2-Dichlorobenzene
GC/MS	EPA 8260B	1,2-Dichloroethane (EDC)
GC/MS	EPA 8260B	1,2-Dichloropropane
GC/MS	EPA 8260B	1,3,5-Trimethylbenzene

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,3-Dichlorobenzene
GC/MS	EPA 8260B	1,3-Dichloropropane
GC/MS	EPA 8260B	1,4-Dichlorobenzene
GC/MS	EPA 8260B	1-Chlorohexane
GC/MS	EPA 8260B	2,2-Dichloropropane
GC/MS	EPA 8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	EPA 8260B	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B	2-Chlorotoluene
GC/MS	EPA 8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	EPA 8260B	4-Chlorotoluene
GC/MS	EPA 8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	EPA 8260B	Acetone
GC/MS	EPA 8260B	Acrolein
GC/MS	EPA 8260B	Acrylonitrile
GC/MS	EPA 8260B	Benzene
GC/MS	EPA 8260B	Bromobenzene
GC/MS	EPA 8260B	Bromochloromethane
GC/MS	EPA 8260B	Bromodichloromethane
GC/MS	EPA 8260B	Bromoform
GC/MS	EPA 8260B	Bromomethane
GC/MS	EPA 8260B	Carbon Disulfide
GC/MS	EPA 8260B	Carbon Tetrachloride
GC/MS	EPA 8260B	Chlorobenzene
GC/MS	EPA 8260B	Chloroethane
GC/MS	EPA 8260B	Chloroform
GC/MS	EPA 8260B	Chloromethane
GC/MS	EPA 8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	EPA 8260B	cis-1,3-Dichloropropene
GC/MS	EPA 8260B	Cyclohexane
GC/MS	EPA 8260B	Dibromochloromethane
GC/MS	EPA 8260B	Dibromomethane
GC/MS	EPA 8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	EPA 8260B	Di-isopropyl ether

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8260B	ETBE
GC/MS	EPA 8260B	Ethyl methacrylate
GC/MS	EPA 8260B	Ethylbenzene
GC/MS	EPA 8260B	Hexachlorobutadiene
GC/MS	EPA 8260B	Iodomethane
GC/MS	EPA 8260B	Isopropylbenzene (Cumene)
GC/MS	EPA 8260B	Methyl Acetate
GC/MS	EPA 8260B	Methyl methacrylate
GC/MS	EPA 8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	EPA 8260B	Methylcyclohexane
GC/MS	EPA 8260B	Methylene Chloride, or Dichloromethane
GC/MS	EPA 8260B	Naphthalene
GC/MS	EPA 8260B	n-Butylbenzene
GC/MS	EPA 8260B	n-Propylbenzene
GC/MS	EPA 8260B	p-Isopropyltoluene
GC/MS	EPA 8260B	sec-Butylbenzene
GC/MS	EPA 8260B	Styrene
GC/MS	EPA 8260B	t-Butyl alcohol
GC/MS	EPA 8260B	tert-Amyl methyl ether
GC/MS	EPA 8260B	tert-Butylbenzene
GC/MS	EPA 8260B	Tetrachloroethene (PCE; PERC)
GC/MS	EPA 8260B	Tetrahydrofuran
GC/MS	EPA 8260B	Toluene
GC/MS	EPA 8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	EPA 8260B	trans-1,3-Dichloropropene
GC/MS	EPA 8260B	Trichloroethene (TCE)
GC/MS	EPA 8260B	Trichlorofluoromethane (CFC-11)
GC/MS	EPA 8260B	Vinyl acetate
GC/MS	EPA 8260B	Vinyl Chloride (VC)
GC/MS	EPA 8260B	Xylenes (Total)
GC/MS	EPA 8270C/D	1,1'-Biphenyl
GC/MS	EPA 8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/D	1,2,4-Trichlorobenzene

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/D	1,2-Diphenylhydrazine
GC/MS	EPA 8270C/D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dioxane
GC/MS	EPA 8270C/D	1-Methylnaphthalene
GC/MS	EPA 8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	EPA 8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	EPA 8270C/D	2,4-Dimethylphenol
GC/MS	EPA 8270C/D	2,4-Dinitrophenol
GC/MS	EPA 8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	EPA 8270C/D	2,6-Dichlorophenol
GC/MS	EPA 8270C/D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/D	2-Chloronaphthalene
GC/MS	EPA 8270C/D	2-Chlorophenol
GC/MS	EPA 8270C/D	2-Methylnaphthalene
GC/MS	EPA 8270C/D	2-Methylphenol (o-Cresol)
GC/MS	EPA 8270C/D	2-Nitroaniline
GC/MS	EPA 8270C/D	2-Nitrophenol (ONP)
GC/MS	EPA 8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	EPA 8270C/D	3-Methylphenol
GC/MS	EPA 8270C/D	3-Nitroaniline
GC/MS	EPA 8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	EPA 8270C/D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/D	4-Chloroaniline
GC/MS	EPA 8270C/D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Methylphenol (p-Cresol)
GC/MS	EPA 8270C/D	4-Nitroaniline (PNA)
GC/MS	EPA 8270C/D	4-Nitrophenol (PNP)
GC/MS	EPA 8270C/D	7,12-Dimethylbenz(a)anthracene

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Acenaphthene
GC/MS	EPA 8270C/D	Acenaphthylene
GC/MS	EPA 8270C/D	Acetaphenone
GC/MS	EPA 8270C/D	Aniline
GC/MS	EPA 8270C/D	Anthracene
GC/MS	EPA 8270C/D	Atrazine
GC/MS	EPA 8270C/D	Benzaldehyde
GC/MS	EPA 8270C/D	Benzidine
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)pyrene
GC/MS	EPA 8270C/D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D	Benzoic Acid
GC/MS	EPA 8270C/D	Benzyl alcohol
GC/MS	EPA 8270C/D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	EPA 8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	EPA 8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	EPA 8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	EPA 8270C/D	Caprolactam
GC/MS	EPA 8270C/D	Carbazole
GC/MS	EPA 8270C/D	Chrysene
GC/MS	EPA 8270C/D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/D	Dibenzofuran (DBF)
GC/MS	EPA 8270C/D	Diethyl phthalate (DEP)
GC/MS	EPA 8270C/D	Dimethyl phthalate (DMP)
GC/MS	EPA 8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	EPA 8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	EPA 8270C/D	Fluoranthene
GC/MS	EPA 8270C/D	Fluorene
GC/MS	EPA 8270C/D	Hexachlorobenzene (HCB)

Non-Potable Water		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Hexachlorobutadiene (HCBD)
GC/MS	EPA 8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	EPA 8270C/D	Hexachloroethane (HCE)
GC/MS	EPA 8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/D	Isophorone
GC/MS	EPA 8270C/D	Naphthalene
GC/MS	EPA 8270C/D	Nitrobenzene
GC/MS	EPA 8270C/D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	EPA 8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	EPA 8270C/D	Pentachlorophenol
GC/MS	EPA 8270C/D	Phenanthrene
GC/MS	EPA 8270C/D	Phenol
GC/MS	EPA 8270C/D	Pyrene
GC/MS	EPA 8270C/D	Pyridine
GC/ECD	EPA 8081A/B	4,4'-DDD
GC/ECD	EPA 8081A/B	4,4'-DDE
GC/ECD	EPA 8081A/B	4,4'-DDT
GC/ECD	EPA 8081A/B	Aldrin
GC/ECD	EPA 8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	EPA 8081A/B	alpha-Chlordane
GC/ECD	EPA 8081A/B	beta-BHC (beta-HCH)
GC/ECD	EPA 8081A/B	delta-BHC (delta-HCH)
GC/ECD	EPA 8081A/B	Dieldrin
GC/ECD	EPA 8081A/B	Endosulfan I
GC/ECD	EPA 8081A/B	Endosulfan II
GC/ECD	EPA 8081A/B	Endosulfan sulfate
GC/ECD	EPA 8081A/B	Endrin
GC/ECD	EPA 8081A/B	Endrin aldehyde
GC/ECD	EPA 8081A/B	Endrin ketone
GC/ECD	EPA 8081A/B	gamma-BHC (Lindane; gamma-HCH)
GC/ECD	EPA 8081A/B	gamma-Chlordane
GC/ECD	EPA 8081A/B	Heptachlor

Non-Potable Water		
Technology	Method	Analyte
GC/ECD	EPA 8081A/B	Heptachlor epoxide
GC/ECD	EPA 8081A/B	Methoxychlor
GC/ECD	EPA 8081A/B	Chlordane
GC/ECD	EPA 8081A/B	Toxaphene
GC/ECD	EPA 8082 /A	Aroclor-1016
GC/ECD	EPA 8082 /A	Aroclor-1221
GC/ECD	EPA 8082 /A	Aroclor-1232
GC/ECD	EPA 8082 /A	Aroclor-1242
GC/ECD	EPA 8082 /A	Aroclor-1248
GC/ECD	EPA 8082 /A	Aroclor-1254
GC/ECD	EPA 8082 /A	Aroclor-1260
GC/ECD	EPA 8082 /A	Aroclor-1262
GC/ECD	EPA 8082 /A	Aroclor-1268
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4,5-TP (Silvex)
GC/ECD	EPA 8151A	2,4-D
GC/ECD	EPA 8151A	2,4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichlorprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP (Mecoprop)
HPLC/UV	EPA 8330A/B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A/B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A/B	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330A/B	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330A/B	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330A/B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A/B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A/B	2-Nitrotoluene (ONT)
HPLC/UV	EPA 8330A/B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/B	3-Nitrotoluene

Non-Potable Water		
Technology	Method	Analyte
HPLC/UV	EPA 8330A/B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A/B	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330A/B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330A/B	Nitrobenzene
HPLC/UV	EPA 8330A/B	Nitroglycerin
HPLC/UV	EPA 8330A/B	Nitroguanidine
HPLC/UV	EPA 8330A/B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330A/B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/B	PETN
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	EPA 8015B	TPH DRO
GC/FID	EPA 8015B	TPH GRO
GC/FID	RSK-175	Methane
GC/FID	RSK-175	Ethane
GC/FID	RSK-175	Ethene
GC/ECD	EPA 8011	1,2-Dibromoethane (EDB)
GC/ECD	EPA 8011	1,2-Dibromo-3-chloropropane (DBCP)
HPLC/MS	EPA 6850	Perchlorate
ICP	EPA 6010B/C	Aluminum
ICP	EPA 6010B/C	Antimony
ICP	EPA 6010B/C	Arsenic
ICP	EPA 6010B/C	Barium
ICP	EPA 6010B/C	Beryllium
ICP	EPA 6010B/C	Boron
ICP	EPA 6010B/C	Cadmium
ICP	EPA 6010B/C	Calcium
ICP	EPA 6010B/C	Chromium, total
ICP	EPA 6010B/C	Cobalt
ICP	EPA 6010B/C	Copper
ICP	EPA 6010B/C	Iron
ICP	EPA 6010B/C	Lead
ICP	EPA 6010B/C	Magnesium
ICP	EPA 6010B/C	Manganese



Non-Potable Water		
Technology	Method	Analyte
CVAA	EPA 6010B/C	Mercury
ICP	EPA 6010B/C	Molybdenum
ICP	EPA 6010B/C	Nickel
ICP	EPA 6010B/C	Potassium
ICP	EPA 6010B/C	Selenium
ICP	EPA 6010B/C	Silver
ICP	EPA 6010B/C	Sodium
ICP	EPA 6010B/C	Strontium
ICP	EPA 6010B/C	Thallium
ICP	EPA 6010B/C	Tin
ICP	EPA 6010B/C	Titanium
ICP	EPA 6010B/C	Vanadium
ICP	EPA 6010B/C	Zinc
IC	EPA 300.0	Chloride
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Nitrite
IC	EPA 300.0	Sulfate
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate
IC	EPA 9056A	Nitrite
IC	EPA 9056A	Sulfate
Titration	SM 2320B 20 th /21 st edition	Alkalinity
Colorimetric	SM 4500 B, G, 20 th /21 st edition	Ammonia
UV/Vis	EPA 7196A	Hexavalent Chromium
Colorimetric	EPA 353.2	Nitrocellulose
Colorimetric	EPA 353.2	Nitrate/Nitrite
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	SM 4500 S-2CF, 20 th /21 st edition	Sulfide
UV/Vis	SM 4500 P B5, E, 20 th /21 st edition	Total Phosphorus (as P)

Non-Potable Water		
Technology	Method	Analyte
UV/Vis	SM 4500 PE, 20 th /21 st edition	Ortho-Phosphate (as P)
TOC	9060A/SM5310C, 20 th /21 st edition	Total Organic Carbon
Gravimetric	SM 2540C, 20 th /21 st edition	TDS
Colorimetric	EPA 9012A/B	Cyanide
Physical	EPA 1010A	Ignitability
Physical	EPA 9095B	Paint Filter
Probe	EPA 9040B/C	pH
Preparation	Method	Type
Preparation	EPA 1311	TCLP
Preparation	EPA 3005A	Metals digestion
Preparation	EPA 3010A	Metals digestion
Preparation	EPA 3510C	Organics Liquid Extraction
Preparation	EPA 5030A/B	Purge and Trap Water

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	1,1,1-Trichloroethane (1,1,1-TCA)
GC/MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)
GC/MS	EPA 8260B	1,1,2-Trichloroethane
GC/MS	EPA 8260B	1,1-Dichloroethane (1,1-DCA)
GC/MS	EPA 8260B	1,1-Dichloroethene (1,1-DCE)
GC/MS	EPA 8260B	1,1-Dichloropropene
GC/MS	EPA 8260B	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B	1,2,3-Trichloropropane
GC/MS	EPA 8260B	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B	1,2-Dibromoethane (EDB)

Solid and Chemical Materials

Technology	Method	Analyte
GC/MS	EPA 8260B	1,2-Dichlorobenzene
GC/MS	EPA 8260B	1,2-Dichloroethane (EDC)
GC/MS	EPA 8260B	1,2-Dichloropropane
GC/MS	EPA 8260B	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B	1,3-Dichlorobenzene
GC/MS	EPA 8260B	1,3-Dichloropropane
GC/MS	EPA 8260B	1,4-Dichlorobenzene
GC/MS	EPA 8260B	2,2-Dichloropropane
GC/MS	EPA 8260B	2-Butanone (Methyl ethyl ketone; MEK)
GC/MS	EPA 8260B	2-Chlorotoluene
GC/MS	EPA 8260B	2-Hexanone (Methyl butyl ketone; MBK)
GC/MS	EPA 8260B	4-Chlorotoluene
GC/MS	EPA 8260B	4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)
GC/MS	EPA 8260B	Acetone
GC/MS	EPA 8260B	Acrolein
GC/MS	EPA 8260B	Acrylonitrile
GC/MS	EPA 8260B	Benzene
GC/MS	EPA 8260B	Bromobenzene
GC/MS	EPA 8260B	Bromochloromethane
GC/MS	EPA 8260B	Bromodichloromethane
GC/MS	EPA 8260B	Bromoform
GC/MS	EPA 8260B	Bromomethane
GC/MS	EPA 8260B	Carbon Disulfide
GC/MS	EPA 8260B	Carbon Tetrachloride
GC/MS	EPA 8260B	Chlorobenzene
GC/MS	EPA 8260B	Chloroethane
GC/MS	EPA 8260B	Chloroform
GC/MS	EPA 8260B	Chloromethane
GC/MS	EPA 8260B	cis-1,2-Dichloroethene (cis-1,2-DCE)
GC/MS	EPA 8260B	cis-1,3-Dichloropropene
GC/MS	EPA 8260B	Cyclohexane
GC/MS	EPA 8260B	Dibromochloromethane

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8260B	Dibromomethane
GC/MS	EPA 8260B	Dichlorodifluoromethane (CFC-12)
GC/MS	EPA 8260B	Ethyl methacrylate
GC/MS	EPA 8260B	Ethylbenzene
GC/MS	EPA 8260B	Hexachlorobutadiene
GC/MS	EPA 8260B	Iodomethane
GC/MS	EPA 8260B	Isopropylbenzene (Cumene)
GC/MS	EPA 8260B	Methyl Acetate
GC/MS	EPA 8260B	Methyl methacrylate
GC/MS	EPA 8260B	Methyl Tertiary Butyl Ether (MTBE)
GC/MS	EPA 8260B	Methylcyclohexane
GC/MS	EPA 8260B	Methylene Chloride, or Dichloromethane
GC/MS	EPA 8260B	Naphthalene
GC/MS	EPA 8260B	n-Butylbenzene
GC/MS	EPA 8260B	n-Propylbenzene
GC/MS	EPA 8260B	p-Isopropyltoluene
GC/MS	EPA 8260B	sec-Butylbenzene
GC/MS	EPA 8260B	Styrene
GC/MS	EPA 8260B	tert-Butylbenzene
GC/MS	EPA 8260B	Tetrachloroethene (PCE; PERC)
GC/MS	EPA 8260B	Toluene
GC/MS	EPA 8260B	trans-1,2-Dichloroethene (trans-1,2-DCE)
GC/MS	EPA 8260B	trans-1,3-Dichloropropene
GC/MS	EPA 8260B	Trichloroethene (TCE)
GC/MS	EPA 8260B	Trichlorofluoromethane (CFC-11)
GC/MS	EPA 8260B	Vinyl acetate
GC/MS	EPA 8260B	Vinyl Chloride (VC)
GC/MS	EPA 8260B	Xylenes (Total)
GC/MS	EPA 8270C/D	Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)
GC/MS	EPA 8270C/D	1,1'-Biphenyl
GC/MS	EPA 8270C/D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C/D	1,2,4-Trichlorobenzene

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	1,2-Dichlorobenzene
GC/MS	EPA 8270C/D	1,2-Diphenylhydrazine
GC/MS	EPA 8270C/D	1,3-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dichlorobenzene
GC/MS	EPA 8270C/D	1,4-Dioxane
GC/MS	EPA 8270C/D	1-Methylnaphthalene
GC/MS	EPA 8270C/D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C/D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C/D	2,4,6-Trichlorophenol (TCP)
GC/MS	EPA 8270C/D	2,4-Dichlorophenol (DCP)
GC/MS	EPA 8270C/D	2,4-Dimethylphenol
GC/MS	EPA 8270C/D	2,4-Dinitrophenol
GC/MS	EPA 8270C/D	2,4-Dinitrotoluene (DNT)
GC/MS	EPA 8270C/D	2,6-Dichlorophenol
GC/MS	EPA 8270C/D	2,6-Dinitrotoluene
GC/MS	EPA 8270C/D	2-Chloronaphthalene
GC/MS	EPA 8270C/D	2-Chlorophenol
GC/MS	EPA 8270C/D	2-Methylnaphthalene
GC/MS	EPA 8270C/D	2-Methylphenol (o-Cresol)
GC/MS	EPA 8270C/D	2-Nitroaniline
GC/MS	EPA 8270C/D	2-Nitrophenol (ONP)
GC/MS	EPA 8270C/D	3,3'-Dichlorobenzidine (DCB)
GC/MS	EPA 8270C/D	3-Methylphenol
GC/MS	EPA 8270C/D	3-Nitroaniline
GC/MS	EPA 8270C/D	4,6-Dinitro-2-methylphenol (DNOC)
GC/MS	EPA 8270C/D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C/D	4-Chloroaniline
GC/MS	EPA 8270C/D	4-Chlorophenyl phenyl ether
GC/MS	EPA 8270C/D	4-Methylphenol (p-Cresol)
GC/MS	EPA 8270C/D	4-Nitroaniline (PNA)
GC/MS	EPA 8270C/D	4-Nitrophenol (PNP)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Acenaphthene
GC/MS	EPA 8270C/D	Acenaphthylene
GC/MS	EPA 8270C/D	Acetaphenone
GC/MS	EPA 8270C/D	Aniline
GC/MS	EPA 8270C/D	Anthracene
GC/MS	EPA 8270C/D	Atrazine
GC/MS	EPA 8270C/D	Benzaldehyde
GC/MS	EPA 8270C/D	Benzidine
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)anthracene
GC/MS	EPA 8270C/D	Benzo(a)pyrene
GC/MS	EPA 8270C/D	Benzo(b)fluoranthene
GC/MS	EPA 8270C/D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C/D	Benzo(k)fluoranthene
GC/MS	EPA 8270C/D	Benzoic Acid
GC/MS	EPA 8270C/D	Benzyl alcohol
GC/MS	EPA 8270C/D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C/D	bis(2-Chloroethyl)ether (BCEE)
GC/MS	EPA 8270C/D	bis(2-Ethylhexyl)phthalate (BEHP)
GC/MS	EPA 8270C/D	Butyl benzyl phthalate (BBP)
GC/MS	EPA 8270C/D	Caprolactam
GC/MS	EPA 8270C/D	Carbazole
GC/MS	EPA 8270C/D	Chrysene
GC/MS	EPA 8270C/D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C/D	Dibenzofuran (DBF)
GC/MS	EPA 8270C/D	Diethyl phthalate (DEP)
GC/MS	EPA 8270C/D	Dimethyl phthalate (DMP)
GC/MS	EPA 8270C/D	Di-n-butyl phthalate (DBP)
GC/MS	EPA 8270C/D	Di-n-octyl phthalate (DNOP)
GC/MS	EPA 8270C/D	Fluoranthene
GC/MS	EPA 8270C/D	Fluorene
GC/MS	EPA 8270C/D	Hexachlorobenzene (HCB)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/MS	EPA 8270C/D	Hexachlorobutadiene (HCBd)
GC/MS	EPA 8270C/D	Hexachlorocyclopentadiene (HCCPD)
GC/MS	EPA 8270C/D	Hexachloroethane (HCE)
GC/MS	EPA 8270C/D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C/D	Isophorone
GC/MS	EPA 8270C/D	Naphthalene
GC/MS	EPA 8270C/D	Nitrobenzene
GC/MS	EPA 8270C/D	N-Nitrosodimethylamine
GC/MS	EPA 8270C/D	N-Nitroso-di-n-propylamine (NDPA)
GC/MS	EPA 8270C/D	N-nitrosodiphenylamine (NDPHA)
GC/MS	EPA 8270C/D	Pentachlorophenol
GC/MS	EPA 8270C/D	Phenanthrene
GC/MS	EPA 8270C/D	Phenol
GC/MS	EPA 8270C/D	Pyrene
GC/MS	EPA 8270C/D	Pyridine
GC/ECD	EPA 8081A/B	4,4'-DDD
GC/ECD	EPA 8081A/B	4,4'-DDE
GC/ECD	EPA 8081A/B	4,4'-DDT
GC/ECD	EPA 8081A/B	Aldrin
GC/ECD	EPA 8081A/B	alpha-BHC (alpha-HCH)
GC/ECD	EPA 8081A/B	alpha-Chlordane
GC/ECD	EPA 8081A/B	beta-BHC (beta-HCH)
GC/ECD	EPA 8081A/B	delta-BHC (delta-HCH)
GC/ECD	EPA 8081A/B	Chlordane
GC/ECD	EPA 8081A/B	Dieldrin
GC/ECD	EPA 8081A/B	Endosulfan I
GC/ECD	EPA 8081A/B	Endosulfan II
GC/ECD	EPA 8081A/B	Endosulfan sulfate
GC/ECD	EPA 8081A/B	Endrin
GC/ECD	EPA 8081A/B	Endrin aldehyde
GC/ECD	EPA 8081A/B	Endrin ketone
GC/ECD	EPA 8081A/B	gamma-BHC (Lindane; gamma-HCH)

Solid and Chemical Materials		
Technology	Method	Analyte
GC/ECD	EPA 8081A/B	gamma-Chlordane
GC/ECD	EPA 8081A/B	Heptachlor
GC/ECD	EPA 8081A/B	Heptachlor epoxide
GC/ECD	EPA 8081A/B	Methoxychlor
GC/ECD	EPA 8081A/B	Toxaphene
GC/ECD	EPA 8082 /A	Aroclor-1016
GC/ECD	EPA 8082 /A	Aroclor-1221
GC/ECD	EPA 8082 /A	Aroclor-1232
GC/ECD	EPA 8082 /A	Aroclor-1242
GC/ECD	EPA 8082 /A	Aroclor-1248
GC/ECD	EPA 8082 /A	Aroclor-1254
GC/ECD	EPA 8082 /A	Aroclor-1260
GC/ECD	EPA 8082 /A	Aroclor-1262
GC/ECD	EPA 8082 /A	Aroclor-1268
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4,5-TP (Silvex)
GC/ECD	EPA 8151A	2,4-D
GC/ECD	EPA 8151A	2,4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichlorprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP (Mecoprop)
HPLC/UV	EPA 8330A	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330A	1,3-Dinitrobenzene
HPLC/UV	EPA 8330A	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330A	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330A	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330A	2,6-Dinitrotoluene
HPLC/UV	EPA 8330A	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330A	2-Nitrotoluene (ONT)

Solid and Chemical Materials		
Technology	Method	Analyte
HPLC/UV	EPA 8330A	3-Nitrotoluene
HPLC/UV	EPA 8330A	3,5-Dinitroaniline
HPLC/UV	EPA 8330A	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330A	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330A	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330A	Nitroglycerin
HPLC/UV	EPA 8330A	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330A	Nitrobenzene
HPLC/UV	EPA 8330A	Nitroguanidine
HPLC/UV	EPA 8330A	PETN
HPLC/UV	EPA 8330B	1,3,5-Trinitrobenzene
HPLC/UV	EPA 8330B	1,3-Dinitrobenzene
HPLC/UV	EPA 8330B	2,4,6-Trinitrophenylmethylnitramine (Tetryl)
HPLC/UV	EPA 8330B	2,4,6-Trinitrotoluene (TNT)
HPLC/UV	EPA 8330B	2,4-Dinitrotoluene (DNT)
HPLC/UV	EPA 8330B	2,6-Dinitrotoluene
HPLC/UV	EPA 8330B	2-Amino-4,6-dinitrotoluene
HPLC/UV	EPA 8330B	2-Nitrotoluene (ONT)
HPLC/UV	EPA 8330B	3-Nitrotoluene
HPLC/UV	EPA 8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330B	4-Amino-2,6-dinitrotoluene
HPLC/UV	EPA 8330B	4-Nitrotoluene (PNT)
HPLC/UV	EPA 8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC/UV	EPA 8330B	Nitroglycerin
HPLC/UV	EPA 8330B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC/UV	EPA 8330B	Nitrobenzene
HPLC/UV	EPA 8330B	Nitroguanidine
HPLC/UV	EPA 8330B	PETN
GC/FID	FLPRO	Petroleum Range Organics
GC/FID	EPA 8015B	TPH DRO
GC/FID	EPA 8015B	TPH GRO
HPLC/MS	EPA 6850	Perchlorate

Solid and Chemical Materials		
Technology	Method	Analyte
ICP	EPA 6010B/C	Aluminum
ICP	EPA 6010B/C	Antimony
ICP	EPA 6010B/C	Arsenic
ICP	EPA 6010B/C	Barium
ICP	EPA 6010B/C	Beryllium
ICP	EPA 6010B/C	Boron
ICP	EPA 6010B/C	Cadmium
ICP	EPA 6010B/C	Calcium
ICP	EPA 6010B/C	Chromium, total
ICP	EPA 6010B/C	Cobalt
ICP	EPA 6010B/C	Copper
ICP	EPA 6010B/C	Iron
ICP	EPA 6010B/C	Lead
ICP	EPA 6010B/C	Magnesium
ICP	EPA 6010B/C	Manganese
CVAA	EPA 7471A/B	Mercury
ICP	EPA 6010B/C	Molybdenum
ICP	EPA 6010B/C	Nickel
ICP	EPA 6010B/C	Potassium
ICP	EPA 6010B/C	Selenium
ICP	EPA 6010B/C	Silver
ICP	EPA 6010B/C	Sodium
ICP	EPA 6010B/C	Strontium
ICP	EPA 6010B/C	Tin
ICP	EPA 6010B/C	Titanium
ICP	EPA 6010B/C	Thallium
ICP	EPA 6010B/C	Vanadium
ICP	EPA 6010B/C	Zinc
UV/Vis	EPA 7196A	Hexavalent Chromium
TOC	Lloyd Kahn	Total Organic Carbon
Colorimetric	EPA 353.2	Nitrocellulose
Colorimetric	EPA 9012A/B	Cyanide

Solid and Chemical Materials		
Technology	Method	Analyte
Titration	Chap.7, Sect. 7.3.4 Mod.	Reactive Sulfide
Titration	EPA 9034	Sulfide
Probe	EPA 9045C/D	pH
Preparation	Method	Type
Preparation	EPA 1311	TCLP
Preparation	EPA 1312	SPLP
Preparation	NJ Modified 3060A	Hexavalent Chromium
Preparation	EPA 3050B	Metals Digestion
Preparation	EPA 3546	Organics Microwave Extraction
Preparation	EPA 3550B/C	Organics Sonication
Preparation	SM 2540B 20 th /21 st edition	Percent Solids (Percent Moisture)
Preparation	EPA 5035 /A	Purge and Trap Solid

Notes:

- 1) This laboratory offers commercial testing service.

Approved By:


R. Douglas Leonard
Chief Technical Officer

Date: January 25, 2011
Issued: 11/30/09
Revised: 2/9/10
Revised: 3/31/10
Revised: 10/8/10
Revised: 1/25/11



State of Florida
Department of Health, Bureau of Laboratories
This is to certify that
E87646

EMPIRICAL LABORATORIES, LLC.
621 MAINSTREAM DRIVE SUITE 270
NASHVILLE, TN 37228

has complied with Florida Administrative Code 64E-1,
for the examination of Environmental samples in the following categories

NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - METALS,
NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, NON-POTABLE WATER - TOXICITY, NON-POTABLE WATER - VOLATILE ORGANICS,
SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - PESTICIDES-HERBICIDES-PCB'S, SOLID AND
CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - VOLATILE
ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE July 01, 2010 THROUGH June 30, 2011



Max Salfinger, M.D.

Chief, Bureau of Laboratories
Florida Department of Health

DH Form 1697, 7/04

NON-TRANSFERABLE E87646-12-07/01/2010
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Page 1 of 21

Attachment to Certificate #: E87646-12, expiration date June 30, 2011. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87646

EPA Lab Code:

TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	4/6/2004
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	4/6/2004
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	4/6/2004
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	4/6/2004
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	4/6/2004
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/5/2006
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	4/6/2004
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011	Volatile Organics	NELAP	8/15/2007
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011	Volatile Organics	NELAP	8/15/2007
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	4/6/2004
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	4/6/2004
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	4/6/2004
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	10/5/2006
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	4/6/2004
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	4/6/2004
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	10/5/2006

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Issue Date: 7/1/2010

Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 2 of 21

Attachment to Certificate #: E87646-12, expiration date June 30, 2011. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87646

EPA Lab Code:

TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	4/6/2004
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	4/6/2004
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	10/5/2006
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	10/5/2006
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	4/6/2004
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	4/6/2004
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	4/6/2004
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	4/6/2004
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	4/6/2004
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	4/6/2004
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/5/2006
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	4/6/2004
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	10/5/2006
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	4/6/2004
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	4/6/2004
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	4/6/2004
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	4/6/2004
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Chlorophenol	EPA 625	Extractable Organics	NELAP	4/6/2004
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Hexanone	EPA 8260	Volatile Organics	NELAP	4/6/2004

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Laboratory Scope of Accreditation

Page 3 of 21

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State Laboratory ID: E87646

EPA Lab Code: TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	4/6/2004
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	4/6/2004
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/6/2004
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	10/5/2006
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	4/6/2004
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	4/6/2004
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	10/5/2006
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	10/5/2006
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	4/6/2004
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/6/2004
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/6/2004
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	4/6/2004
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	10/5/2006
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	4/6/2004
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	4/6/2004
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	4/6/2004
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	10/5/2006
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	4/6/2004
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	4/6/2004

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Laboratory Scope of Accreditation

Page 4 of 21

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EPA Lab Code: TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	4/6/2004
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/6/2004
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	10/5/2006
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	10/5/2006
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
Acenaphthene	EPA 625	Extractable Organics	NELAP	4/6/2004
Acenaphthene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Acenaphthylene	EPA 625	Extractable Organics	NELAP	4/6/2004
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Acetone	EPA 8260	Volatile Organics	NELAP	4/6/2004
Acetonitrile	EPA 8260	Volatile Organics	NELAP	10/5/2006
Acetophenone	EPA 8270	Extractable Organics	NELAP	10/5/2006
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	4/6/2004
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	3/4/2008
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aluminum	EPA 200.7	Metals	NELAP	4/6/2004
Aluminum	EPA 6010	Metals	NELAP	4/6/2004
Amenable cyanide	SM 4500-CN G	General Chemistry	NELAP	3/4/2008
Ammonia as N	SM 4500-NH3 G	General Chemistry	NELAP	3/4/2008
Aniline	EPA 8270	Extractable Organics	NELAP	10/5/2006
Anthracene	EPA 625	Extractable Organics	NELAP	4/6/2004
Anthracene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Antimony	EPA 200.7	Metals	NELAP	4/6/2004
Antimony	EPA 6010	Metals	NELAP	4/6/2004
Aramite	EPA 8270	Extractable Organics	NELAP	10/5/2006
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004

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Issue Date: 7/1/2010

Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 5 of 21

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TN00004

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Empirical Laboratories, LLC.

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Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Arsenic	EPA 200.7	Metals	NELAP	4/6/2004
Arsenic	EPA 6010	Metals	NELAP	4/6/2004
Barium	EPA 200.7	Metals	NELAP	4/6/2004
Barium	EPA 6010	Metals	NELAP	4/6/2004
Benzene	EPA 624	Volatile Organics	NELAP	4/6/2004
Benzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Benzidine	EPA 625	Extractable Organics	NELAP	4/6/2004
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	4/6/2004
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	4/6/2004
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	4/6/2004
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	4/6/2004
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	4/6/2004
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	10/5/2006
Beryllium	EPA 200.7	Metals	NELAP	4/6/2004
Beryllium	EPA 6010	Metals	NELAP	4/6/2004
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	3/4/2008
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	4/6/2004

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Laboratory Scope of Accreditation

Page 6 of 21

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EPA Lab Code:

TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	4/6/2004
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	4/6/2004
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	4/6/2004
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 625	Extractable Organics	NELAP	4/6/2004
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	4/6/2004
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	4/6/2004
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	4/6/2004
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	10/5/2006
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	4/6/2004
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Bromoform	EPA 624	Volatile Organics	NELAP	4/6/2004
Bromoform	EPA 8260	Volatile Organics	NELAP	4/6/2004
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	4/6/2004
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Cadmium	EPA 200.7	Metals	NELAP	4/6/2004
Cadmium	EPA 6010	Metals	NELAP	4/6/2004
Calcium	EPA 6010	Metals	NELAP	4/6/2004
Carbazole	EPA 8270	Extractable Organics	NELAP	4/6/2004
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	4/6/2004
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	4/6/2004
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	4/6/2004
Ceriodaphnia dubia	EPA 821-R-02-012 (FW acute)(2002.0)	Toxicity	NELAP	7/1/2009
Ceriodaphnia dubia	EPA 821-R-02-013 (FW chronic)(1002.0)	Toxicity	NELAP	7/1/2009
Chemical oxygen demand	EPA 410.4	General Chemistry	NELAP	4/6/2004
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Chloride	EPA 300.0	General Chemistry	NELAP	4/6/2004
Chlorobenzene	EPA 624	Volatile Organics	NELAP	4/6/2004
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Chlorobenzilate	EPA 8270	Extractable Organics	NELAP	10/5/2006
Chloroethane	EPA 624	Volatile Organics	NELAP	4/6/2004
Chloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Chloroform	EPA 624	Volatile Organics	NELAP	4/6/2004
Chloroform	EPA 8260	Volatile Organics	NELAP	4/6/2004

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Laboratory Scope of Accreditation

Page 7 of 21

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Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chromium	EPA 200.7	Metals	NELAP	4/6/2004
Chromium	EPA 6010	Metals	NELAP	4/6/2004
Chromium VI	EPA 7196	General Chemistry	NELAP	4/6/2004
Chromium VI	SM 3500-Cr D (18th/19th Ed.)/UV-VIS	General Chemistry	NELAP	4/6/2004
Chrysene	EPA 625	Extractable Organics	NELAP	4/6/2004
Chrysene	EPA 8270	Extractable Organics	NELAP	4/6/2004
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/6/2004
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	4/6/2004
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Cobalt	EPA 200.7	Metals	NELAP	4/6/2004
Cobalt	EPA 6010	Metals	NELAP	4/6/2004
Conductivity	EPA 120.1	General Chemistry	NELAP	4/6/2004
Copper	EPA 200.7	Metals	NELAP	4/6/2004
Copper	EPA 6010	Metals	NELAP	4/6/2004
Cyprinella leedsi	EPA 821-R-02-012 (FW acute)(2000.0)	Toxicity	NELAP	7/1/2009
Cyprinodon variegatus	EPA 821-R-02-012 (SW acute)(2004.0)	Toxicity	NELAP	7/1/2009
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Daphnia magna	EPA 821-R-02-012 (FW acute)(2021.0)	Toxicity	NELAP	7/1/2009
Daphnia pulex	EPA 821-R-02-012 (FW acute)(2021.0)	Toxicity	NELAP	7/1/2009
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Dibenz(a,h)anthracene	EPA 625	Extractable Organics	NELAP	4/6/2004
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	4/6/2004
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	4/6/2004
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Dibromomethane	EPA 8260	Volatile Organics	NELAP	10/5/2006
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004

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Laboratory Scope of Accreditation

Page 8 of 21

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	4/6/2004
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	4/6/2004
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Dimethoate	EPA 8270	Extractable Organics	NELAP	10/5/2006
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	4/6/2004
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	4/6/2004
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	4/6/2004
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Diphenylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/5/2006
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/5/2006
Ethylbenzene	EPA 624	Volatile Organics	NELAP	4/6/2004
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Fluoranthene	EPA 625	Extractable Organics	NELAP	4/6/2004
Fluoranthene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Fluorene	EPA 625	Extractable Organics	NELAP	4/6/2004
Fluorene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Fluoride	EPA 300.0	General Chemistry	NELAP	4/6/2004

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program.

Issue Date: 7/1/2010

Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 9 of 21

Attachment to Certificate #: E87646-12, expiration date June 30, 2011. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87646

EPA Lab Code:

TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Gasoline range organics (GRO)	EPA 8015	Volatile Organics	NELAP	4/6/2004
Hardness (calc.)	EPA 200.7	General Chemistry	NELAP	4/6/2004
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	4/6/2004
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	4/6/2004
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	4/6/2004
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Hexachloroethane	EPA 625	Extractable Organics	NELAP	4/6/2004
Hexachloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	4/6/2004
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	10/5/2006
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	10/5/2006
Ignitability	EPA 1010	General Chemistry	NELAP	4/6/2004
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	4/6/2004
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	10/5/2006
Iron	EPA 200.7	Metals	NELAP	4/6/2004
Iron	EPA 6010	Metals	NELAP	4/6/2004
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	10/5/2006
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Isophorone	EPA 625	Extractable Organics	NELAP	4/6/2004
Isophorone	EPA 8270	Extractable Organics	NELAP	4/6/2004
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	10/5/2006
Isosafrole	EPA 8270	Extractable Organics	NELAP	10/5/2006
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006

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Laboratory Scope of Accreditation

Page 10 of 21

Attachment to Certificate #: E87646-12, expiration date June 30, 2011. This listing of accredited analytes should be used only when associated with a valid certificate.

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EPA Lab Code:

TN00004

(615) 345-1115

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Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Kjeldahl nitrogen - total	EPA 351.2	General Chemistry	NELAP	4/6/2004
Lead	EPA 200.7	Metals	NELAP	4/6/2004
Lead	EPA 6010	Metals	NELAP	4/6/2004
Magnesium	EPA 200.7	Metals	NELAP	4/6/2004
Magnesium	EPA 6010	Metals	NELAP	4/6/2004
Manganese	EPA 200.7	Metals	NELAP	4/6/2004
Manganese	EPA 6010	Metals	NELAP	4/6/2004
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Menidia beryllina	EPA 821-R-02-012 (SW acute)(2006.0)	Toxicity	NELAP	7/1/2009
Menidia menidia	EPA 821-R-02-012 (SW acute)(2006.0)	Toxicity	NELAP	7/1/2009
Menidia peninsulae	EPA 821-R-02-012 (SW acute)(2006.0)	Toxicity	NELAP	7/1/2009
Mercury	EPA 245.1	Metals	NELAP	4/6/2004
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	10/5/2006
Methapyrilene	EPA 8270	Extractable Organics	NELAP	10/5/2006
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	4/6/2004
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	4/6/2004
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/5/2006
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/5/2006
Methyl parathion (Parathion, methyl)	EPA 8270	Extractable Organics	NELAP	10/5/2006
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Methylene chloride	EPA 624	Volatile Organics	NELAP	4/6/2004
Methylene chloride	EPA 8260	Volatile Organics	NELAP	4/6/2004
Molybdenum	EPA 200.7	Metals	NELAP	4/6/2004
Molybdenum	EPA 6010	Metals	NELAP	4/6/2004
Mysidopsis bahia	EPA 821-R-02-012 (SW acute)(2007.0)	Toxicity	NELAP	7/1/2009
Naphthalene	EPA 625	Extractable Organics	NELAP	4/6/2004
Naphthalene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Naphthalene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Nickel	EPA 200.7	Metals	NELAP	4/6/2004
Nickel	EPA 6010	Metals	NELAP	4/6/2004

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Laboratory Scope of Accreditation

Page 11 of 21

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(615) 345-1115

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Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Nitrate as N	EPA 300.0	General Chemistry	NELAP	4/6/2004
Nitrobenzene	EPA 625	Extractable Organics	NELAP	4/6/2004
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	4/6/2004
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	4/6/2004
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	4/6/2004
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	4/6/2004
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	4/6/2004
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	10/5/2006
o,o,o-Triethyl phosphorothioate	EPA 8270	Extractable Organics	NELAP	10/5/2006
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	4/6/2004
Oil & Grease	EPA 1664A	General Chemistry	NELAP	4/6/2004
Orthophosphate as P	SM 4500-P E	General Chemistry	NELAP	3/4/2008
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Pentachloronitrobenzene (Quintozene)	EPA 8270	Extractable Organics	NELAP	10/5/2006
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	4/6/2004
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
pH	EPA 9040	General Chemistry	NELAP	4/6/2004
pH	SM 4500-H+-B	General Chemistry	NELAP	3/4/2008
Phenacetin	EPA 8270	Extractable Organics	NELAP	10/5/2006
Phenanthrene	EPA 625	Extractable Organics	NELAP	4/6/2004
Phenanthrene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Phenol	EPA 625	Extractable Organics	NELAP	4/6/2004
Phenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
Phosphorus, total	SM 4500-P E	General Chemistry	NELAP	3/4/2008
Pimephales promelas	EPA 821-R-02-012 (FW acute)(2000.0)	Toxicity	NELAP	7/1/2009
Potassium	EPA 6010	Metals	NELAP	4/6/2004
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	10/5/2006

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Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 12 of 21

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(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	10/5/2006
Pyrene	EPA 625	Extractable Organics	NELAP	4/6/2004
Pyrene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Pyridine	EPA 8270	Extractable Organics	NELAP	4/6/2004
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	4/6/2004
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	3/4/2008
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	3/4/2008
Residue-total	SM 2540 B	General Chemistry	NELAP	3/4/2008
Saftrole	EPA 8270	Extractable Organics	NELAP	10/5/2006
Selenium	EPA 200.7	Metals	NELAP	4/6/2004
Selenium	EPA 6010	Metals	NELAP	4/6/2004
Silver	EPA 200.7	Metals	NELAP	4/6/2004
Silver	EPA 6010	Metals	NELAP	4/6/2004
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Sodium	EPA 200.7	Metals	NELAP	4/6/2004
Sodium	EPA 6010	Metals	NELAP	4/6/2004
Styrene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Sulfate	EPA 300.0	General Chemistry	NELAP	4/6/2004
Sulfide	SM 4500-S E (18th Ed.)/TITR	General Chemistry	NELAP	3/4/2008
Sulfotep	EPA 8270	Extractable Organics	NELAP	10/5/2006
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	4/6/2004
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	4/6/2004
Thallium	EPA 200.7	Metals	NELAP	4/6/2004
Thallium	EPA 6010	Metals	NELAP	4/6/2004
Thionazin (Zinophos)	EPA 8270	Extractable Organics	NELAP	10/5/2006
Tin	EPA 200.7	Metals	NELAP	4/6/2004
Tin	EPA 6010	Metals	NELAP	4/6/2004
Toluene	EPA 624	Volatile Organics	NELAP	4/6/2004
Toluene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Total cyanide	EPA 9012	General Chemistry	NELAP	4/6/2004
Total nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	4/6/2004
Total organic carbon	EPA 9060	General Chemistry	NELAP	7/29/2004
Total organic carbon	SM 5310 C	General Chemistry	NELAP	3/4/2008
Total Petroleum Hydrocarbons (TPH)	FL-PRO	Extractable Organics	NELAP	4/6/2004

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Laboratory Scope of Accreditation

Page 13 of 21

Attachment to Certificate #: E87646-12, expiration date June 30, 2011. This listing of accredited analytes should be used only when associated with a valid certificate.

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EPA Lab Code:

TN00004

(615) 345-1115

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Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Total phenolics	EPA 420.1	General Chemistry	NELAP	4/6/2004
Total phenolics	EPA 420.2	General Chemistry	NELAP	4/6/2004
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	4/6/2004
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/6/2004
trans-1,3-Dichloropropylene	EPA 624	Volatile Organics	NELAP	4/6/2004
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	10/5/2006
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	4/6/2004
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	4/6/2004
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Turbidity	EPA 180.1	General Chemistry	NELAP	4/6/2004
Vanadium	EPA 200.7	Metals	NELAP	4/6/2004
Vanadium	EPA 6010	Metals	NELAP	4/6/2004
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	10/5/2006
Vinyl chloride	EPA 624	Volatile Organics	NELAP	4/6/2004
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	4/6/2004
Xylene (total)	EPA 624	Volatile Organics	NELAP	4/6/2004
Xylene (total)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Zinc	EPA 200.7	Metals	NELAP	4/6/2004
Zinc	EPA 6010	Metals	NELAP	4/6/2004

Laboratory Scope of Accreditation

Page 14 of 21

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State Laboratory ID: E87646

EPA Lab Code:

TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/5/2006
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	10/5/2006
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	4/6/2004
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	10/5/2006
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	4/6/2004
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	10/5/2006
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	10/5/2006
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	10/5/2006
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	4/6/2004
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004

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Issue Date: 7/1/2010

Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 15 of 21

Attachment to Certificate #: E87646-12, expiration date June 30, 2011. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87646

EPA Lab Code: TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	4/6/2004
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/5/2006
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	4/6/2004
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	4/6/2004
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	10/5/2006
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	4/6/2004
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	4/6/2004
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Hexanone	EPA 8260	Volatile Organics	NELAP	4/6/2004
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/6/2004
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	10/5/2006
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	4/6/2004
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	10/5/2006
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	10/5/2006
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	4/6/2004
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/6/2004
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/6/2004
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	4/6/2004
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	10/5/2006
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	4/6/2004

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Issue Date: 7/1/2010

Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 16 of 21

Attachment to Certificate #: E87646-12, expiration date June 30, 2011. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87646

EPA Lab Code:

TN00004

(615) 345-1115

E87646

Empirical Laboratories, LLC.

621 Mainstream Drive

Suite 270

Nashville, TN 37228

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	10/5/2006
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	4/6/2004
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	4/6/2004
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	10/5/2006
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	10/5/2006
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
Acenaphthene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Acetone	EPA 8260	Volatile Organics	NELAP	4/6/2004
Acetonitrile	EPA 8260	Volatile Organics	NELAP	10/5/2006
Acetophenone	EPA 8270	Extractable Organics	NELAP	10/5/2006
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	4/6/2004
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aluminum	EPA 6010	Metals	NELAP	4/6/2004
Aniline	EPA 8270	Extractable Organics	NELAP	10/5/2006
Anthracene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Antimony	EPA 6010	Metals	NELAP	4/6/2004
Aramite	EPA 8270	Extractable Organics	NELAP	10/5/2006
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Arsenic	EPA 6010	Metals	NELAP	4/6/2004
Barium	EPA 6010	Metals	NELAP	4/6/2004
Benzene	EPA 8260	Volatile Organics	NELAP	4/6/2004

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Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 17 of 21

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	10/5/2006
Beryllium	EPA 6010	Metals	NELAP	4/6/2004
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	4/6/2004
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	4/6/2004
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	4/6/2004
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	4/6/2004
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	10/5/2006
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Bromoform	EPA 8260	Volatile Organics	NELAP	4/6/2004
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Cadmium	EPA 6010	Metals	NELAP	4/6/2004
Calcium	EPA 6010	Metals	NELAP	4/6/2004
Carbazole	EPA 8270	Extractable Organics	NELAP	4/6/2004
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	4/6/2004
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	4/6/2004
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Chloride	EPA 9056	General Chemistry	NELAP	4/6/2004
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Chloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Chloroform	EPA 8260	Volatile Organics	NELAP	4/6/2004
Chromium	EPA 6010	Metals	NELAP	4/6/2004
Chromium VI	EPA 7196	Metals,General Chemistry	NELAP	4/6/2004
Chrysene	EPA 8270	Extractable Organics	NELAP	4/6/2004
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/6/2004
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Cobalt	EPA 6010	Metals	NELAP	4/6/2004
Copper	EPA 6010	Metals	NELAP	4/6/2004
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004

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Issue Date: 7/1/2010

Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 18 of 21

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	4/6/2004
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Dibromomethane	EPA 8260	Volatile Organics	NELAP	10/5/2006
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	4/6/2004
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	4/6/2004
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	10/5/2006
Diphenylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/5/2006
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/5/2006
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Fluoranthene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Fluorene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Fluoride	EPA 9056	General Chemistry	NELAP	4/6/2004
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	4/6/2004

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Issue Date: 7/1/2010

Expiration Date: 6/30/2011

Laboratory Scope of Accreditation

Page 19 of 21

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Hexachlorobenzene	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Hexachloroethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	4/6/2004
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	10/5/2006
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	10/5/2006
Ignitability	EPA 1010	General Chemistry	NELAP	4/6/2004
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	10/5/2006
Iron	EPA 6010	Metals	NELAP	4/6/2004
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	10/5/2006
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Isophorone	EPA 8270	Extractable Organics	NELAP	4/6/2004
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	10/5/2006
Isosafrole	EPA 8270	Extractable Organics	NELAP	10/5/2006
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Lead	EPA 6010	Metals	NELAP	4/6/2004
Magnesium	EPA 6010	Metals	NELAP	4/6/2004
Manganese	EPA 6010	Metals	NELAP	4/6/2004
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Mercury	EPA 7471	Metals	NELAP	4/6/2004
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	10/5/2006
Methapyrilene	EPA 8270	Extractable Organics	NELAP	10/5/2006
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/5/2006
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/5/2006

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Laboratory Scope of Accreditation

Page 20 of 21

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Methylene chloride	EPA 8260	Volatile Organics	NELAP	4/6/2004
Molybdenum	EPA 6010	Metals	NELAP	4/6/2004
Naphthalene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Naphthalene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Nickel	EPA 6010	Metals	NELAP	4/6/2004
Nitrate	EPA 9056	General Chemistry	NELAP	4/6/2004
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	4/6/2004
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	4/6/2004
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	4/6/2004
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	10/5/2006
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	10/5/2006
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	4/6/2004
Paint Filter Liquids Test	EPA 9095	General Chemistry	NELAP	4/6/2004
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/5/2006
Pentachloronitrobenzene (Quintozone)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
Perchlorate	EPA 6850	General Chemistry	NELAP	7/1/2009
pH	EPA 9040	General Chemistry	NELAP	4/6/2004
pH	EPA 9045	General Chemistry	NELAP	4/6/2004
Phenacetin	EPA 8270	Extractable Organics	NELAP	10/5/2006
Phenanthrene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Phenol	EPA 8270	Extractable Organics	NELAP	4/6/2004
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Potassium	EPA 6010	Metals	NELAP	4/6/2004
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	10/5/2006

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Laboratory Scope of Accreditation

Page 21 of 21

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	10/5/2006
Pyrene	EPA 8270	Extractable Organics	NELAP	4/6/2004
Pyridine	EPA 8270	Extractable Organics	NELAP	4/6/2004
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	4/6/2004
Safrole	EPA 8270	Extractable Organics	NELAP	10/5/2006
Selenium	EPA 6010	Metals	NELAP	4/6/2004
Silver	EPA 6010	Metals	NELAP	4/6/2004
Sodium	EPA 6010	Metals	NELAP	4/6/2004
Styrene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Sulfate	EPA 9056	General Chemistry	NELAP	4/6/2004
Sulfotep	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	4/6/2004
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	4/6/2004
Thallium	EPA 6010	Metals	NELAP	4/6/2004
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/5/2006
Tin	EPA 6010	Metals	NELAP	4/6/2004
Toluene	EPA 8260	Volatile Organics	NELAP	4/6/2004
Total cyanide	EPA 9012	General Chemistry	NELAP	4/6/2004
Total organic carbon	EPA 9060	General Chemistry	NELAP	7/29/2004
Total Petroleum Hydrocarbons (TPH)	FL-PRO	Extractable Organics	NELAP	4/6/2004
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/6/2004
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	4/6/2004
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	4/6/2004
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	4/6/2004
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	10/5/2006
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	4/6/2004
Vanadium	EPA 6010	Metals	NELAP	4/6/2004
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	10/5/2006
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	4/6/2004
Xylene (total)	EPA 8260	Volatile Organics	NELAP	4/6/2004
Zinc	EPA 6010	Metals	NELAP	4/6/2004

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program.

Issue Date: 7/1/2010

Expiration Date: 6/30/2011